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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The study reflected by this document surveyed the extent to which commercial automatic data processing (ADP) equipment is used in the ocean environment. The range of such applications and their relative success are surveyed, to assist in further decisions on such equipment in Operational Readiness Monitoring System (ORMS) uses.

This document is provided in two volumes. Volume One is the narrative overview of the study. It covers study methodology, ORMS background, study findings, conclusions and recommendations. Volume Two is a collection of user documents in appendix form. These user appendices are reproduced as provided by the various commercial ADP equipment users and present detailed descriptions of equipment applications.

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Vol II

Technical Document 228

COMMERCIAL DIGITAL/ADP EQUIPMENT IN THE OCEAN ENVIRONMENT

Volume II: User Appendices

JG Kammerer

Final Report: July — November 1978

15 December 1978

Prepared for
Naval Data Automation Command

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CALIFORNIA 92152

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

RR GAVAZZI, CAPT, USN
Commander

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Technical Director

ADMINISTRATIVE INFORMATION

The work covered by this technical document was performed by the Systems Integration Branch as part of NOSC Project CC08 and was sponsored by the Naval Data Automation Command (NAVDAC Code 72).

The author of this technical document expresses his appreciation for the support provided by Mr J Gentry of SDC Integrated Services, Inc. Thanks are especially due for the cooperation and enthusiasm exhibited by the following personnel who were contacted (in order of contact): LCDR Dollard and CPO Pharr, USS GRIDLEY (CG 21); CAPT BS Little, USCGC GLACIER; CDR Miller, Messrs G DuPont, Jr, and H Meyers, NAVOCEANO; LT (JG) Reusch, USS KITTY HAWK (CV 63); CAPT Kothe, CDR Lonhorn, and ETCS Pinney, USCGC POLAR SEA; CDR Harshberger, COMNAVAIRPAC; Mr P Sutton, COMNAVSURFPAC; CDR Bolinger, NALC; Mr E Heaton, PRD Electronics; and Mr J Grant, NOSC.

Released by
CA Nelson, Head
Surface Ship Systems Division

Under Authority of
HD Smith, Head
Communications Systems and
Technology Department

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APPENDIX A

USS GRIDLEY (CG 21), INFORMATION PROVIDED

This appendix contains information concerning the use of commercial ADP equipment aboard ship and the Automated Shipboard Information Management System (ASIMS) as follows:

- Hardware System Reliability and Maintainability (extract)
- Letter, USS GRIDLEY (CG 21) ASIMS Status Report

1.0 HARDWARE SYSTEM RELIABILITY AND MAINTAINABILITY

An evaluation period of 511 consecutive days was used to determine an overall equipment reliability factor of .928 for the ASIMS hardware suite aboard the USS GRIDLEY (CG 21). ASIMS operating logs, maintenance contractor field service reports, and system operator interviews were used to assess individual system component reliability factors. Table A-1 lists these component reliabilities using the following formula:

$$r_i = 1 \frac{-d_i}{D} = 1 \frac{-d_i}{511}$$

where r_i = component i reliability factor

d_i = number of days component i inoperative

D = number of days in evaluation period (i.e., D = 511)

TABLE A-1. ASIMS HARDWARE COMPONENT RELIABILITY FACTORS

COMPONENT	RELIABILITY FACTORS
Line Printer (80 characters)	1.000
Card Reader	1.000
CRT Display Terminal #1	1.000
Disk Drive Unit #1	.998
CRT Display Terminal #2	.998
Disk Drive Unit #2	.954
Teletype Control Console	.951
CRT Display Terminal #3	.949
Central Processing Unit	.928
Cassette Tape Unit #1	.880
Line Printer (132 characters)	.820
CRT Display Terminal #4	.485
Cassette Tape Unit #2	.366

During the evaluation period it was determined that ASIMS could function adequately aboard GRIDLEY with a minimum of component equipment, e.g., a CPU, a line printer (80 or 132 character), a teletype control console, and two CRT display terminals. Assuming that total ASIMS reliability would depend upon the availability of such a nucleus, any estimate of total ASIMS reliability should not exceed the reliability factor of the weakest component of the nucleus group. Consequently, a reliability factor of r = .928, the component reliability factor of the CPU (see table A-1), was selected as a gross estimate for a total ASIMS reliability factor.

ASIMS performed well underway, in rough seas, during periods of heavy vibration (e.g., gun shoots, missile firing, and backing engines), in variable temperatures (55°-85°F), and in the presence of radar radiation on the 05 level aboard GRIDLEY. The reader is reminded that ASIMS hardware was originally in use aboard USS DAHLGREN from 1973 to 1975, and at Navy Personnel Research and Development Center (NAVPERSRANDCEN) from 1975 to 1976, before being used aboard GRIDLEY. At the end of the evaluation period in late 1977, the minicomputer and peripherals were all operational and functioning.

While under maintenance contract with Data General Corporation, most ASIMS repairs were accomplished onboard GRIDLEY during a one-day maintenance visit. Maintenance usually consisted of replacing parts and making minor adjustments to equipment components. However, a disk drive unit, a cassette tape unit, and a CRT display terminal had to be removed from GRIDLEY for depot repair by Data General Corporation. The system operator performed some preventative maintenance, such as cleaning disk drive read/write heads and replacing deteriorating line printer control tapes. Equipment downtime was attributed, in part, to waiting upon contractor maintenance technicians to reach the ship, which often was inaccessible (e.g. at sea), or competition with other higher commercial clients for maintenance time.

1.1 ASIMS Hardware Component Reliability and Maintenance History

1.1.1 CPU. The CPU had a reliability of .928 and a downtime percentage of approximately 7 percent. CPU malfunctions were limited to one bad 8K core memory board, a power supply failure, and minor problems with various peripheral I/O circuit boards. All repairs were made onboard ship by Data General technicians and involved only replacement of parts. Approximately 5 percent (25 days) of CPU downtime was attributed to waiting for a maintenance technician to be summoned and transported to GRIDLEY while the ship was deployed in the Western Pacific during 1976. Several times the CPU became inoperative due to dirty read/write heads on the disk drive units or to faulty I/O device connections (e.g., loose or shorted wire to a remote video display terminal). These problems were corrected as they occurred, by the system operators.

1.1.2 DISK DRIVE UNITS (2). One disk drive unit had a reliability of .998 (1 percent downtime); the second unit had a reliability of .954 (5 percent downtime). Significant malfunctions were as follows:

- Damaged logic control board caused by electrical arcing on the board. Unit was replaced with a factory spare and repaired at a Data General repair depot in about 20 days.
- Phasing and sequence timing difficulty occurred twice and was repaired with minor adjustments by Data General maintenance technicians.
- Dirty read/write heads that caused parity errors and CPU shutdown occurred twice. Heads were cleaned by system operators using an alcohol base cleaning fluid and a lint-free tissue. This became a regular semiannual planned maintenance system (PMS) check. Disks collected dirt during initial system installation in 1976 due to aluminum welding work in the computer room. Smoking also contributed to dirty read/write heads and was prohibited in the computer space in early 1977.
- Several fuses were blown and replaced.

1.1.3 CASSETTE TAPE UNITS (CTU). There were two cassette tape units, each containing three independent cassette tape drives. One CTU had a reliability of .88 (12 percent downtime); the other .366 (63 percent downtime). The CTUs were found to be of poor-quality construction and experienced a high casualty rate. One CTU was eventually determined to be "beyond economical repair" in early 1977 after 10 months of intermittent operation. The other CTU had either one or two of the three cassette tape drives inoperative. Most problems with the CTUs involved worn or broken parts, such as bushings, brakes, fans, chips, diodes, and transistors. These units were generally not repairable onboard ship due to inexperience by the maintenance technicians on CTU repairs and/or lack of parts. When a CTU did operate, it required frequent adjustments and cleaning by the system operators.

The nonavailability of the cassette tape units or drives resulted in an inability by the system operators to build backup files, maintain historical data, conduct diagnostics, and add/transfer data to and from the disks. Extra disk space had to be allocated to perform these CTU functions. Even when the CTUs were operating, their use for data storage was discouraged because of their limited capacity (40K words) and long run time (up to 10 minutes).

1.1.4. TELETYPE COMPUTER CONSOLE (TTY). The TTY had a reliability of .951 (5 percent downtime). The TTY was rebuilt in 1975 by NAVPERSRANDCEN because of spray-paint damage that had occurred during installation aboard DAHLGREN. The paper tape punch-reader never operated properly while onboard GRIDLEY. A nylon gear had to be replaced in October 1976. Minor lubrication and PMS adjustments were occasionally performed by the Data General maintenance technicians.

1.1.5 LINE PRINTER (132 CHARACTERS). The 132-character line printer had a reliability of .820 (18 percent downtime). This printer experienced several malfunctions as follows:

- On six occasions control and logic circuit cards had to be replaced or repaired due to possible equipment overload. On-site soldering or chip repairs were made by Data General maintenance technicians or by a system operator receiving directions from such technicians via telephone.

- Four carriage control mylar tape ribbons that control printer paper paging had to be replaced and/or realigned. This repair was done by either a maintenance technician or a system operator.
- Four printer hammers had to be replaced by a maintenance technician.
- A washer dropped into the printer while civilian contractor personnel were installing equipment above the printer, and resulted in the destruction of two magnetic strips and five printer hammers. Maintenance technicians made all necessary repairs.
- A rubber printing drum belt broke and was replaced by a maintenance technician.
- Other minor problems involved adjusting the drum timing ring, repairing a magnetic backing strip, and replacing a deteriorated wiring harness and worn wires. These repairs were accomplished by a maintenance technician.

1.1.6 LINE PRINTER (80 CHARACTERS). The 80-character line printer had a reliability of 1,000 (0 percent downtime). This printer was rebuilt in 1975 by NAVPERSRANDCEN due to improper storage while on DAHLGREN. While on GRIDLEY, it was used as a backup printer and operated about 18 percent of the time. No PMS nor maintenance of any type was performed on this printer. A gravity switch that caused the printer to be turned off during heavy rolling at sea was taped-off by the system operator to prevent printer shutoff.

1.1.7 CARD READER. The card reader had a reliability of 1.000 (0 percent downtime) and was used less than 20 times to read cards. An operating software problem, which was not resolved until mid-1977, caused data to be garbled when the unit was used. Maintenance personnel experienced difficulty with blown fuses while performing preventive maintenance. This problem was eliminated by using "slow-blow" fuses as specified by the manufacturer.

1.1.8 VIDEO DISPLAY TERMINALS (CRTs). There were four CRTs in the computer system on GRIDLEY. Since the CRTs were interchangeable their reliability was 1.000, .998, .949, and .485 (0, 1, 5, and 56 percent downtime), respectively.

For example, at least one of the CRTs was inoperative 56 percent of the time. CRT malfunctions included a faulty shift key, dirty or corroded aluminum contacts, bad I/O boards, faulty keyboard characters, and loose or shorted connector plugs. Even if a malfunction was considered minor or intermittent, such as a bad character display for one character, the CRT was logged out of commission. The CRT with the bad shift key took 150 days to be repaired at a Data General repair depot.

2.0 ASIMS STATUS REPORT, USS GRIDLEY (CG 21)

See following letter and enclosures.

DEPARTMENT OF THE NAVY

NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER
SAN DIEGO, CALIFORNIA 92152

306:JAD:llp
Z0108-PN.14B
Ser 636
1 Nov 1978

From: Commanding Officer
To: Distribution List

Subj: USS GRIDLEY (CG 21) Automated Shipboard Information Management System (ASIMS) Status Report; distribution of

Encl: (1) CO USS GRIDLEY (CG 21) ltr 3900 Ser 302 of 12 Sep 1978 (less encls (2)-(5), (7)-(13) and (15))

1. Enclosure (1) is forwarded for interest and information.

2. Attention is invited to enclosure (14) of the ASIMS report, which might be of value to the SNAP I and SNAP II programs. This enclosure contains an equipment and maintenance history summary of the Data General Corporation NOVA 1200 minicomputer system used aboard GRIDLEY.

J E Blasko
J. E. BLASKO
Acting

Distribution (w/encl)
NAVDAC (Code 3143, Attn: LCDR Clark)
(Code 70, Attn: Mr. Richard Fredette)
NAVSEASYSCOM (SEA 04K, Attn: Mr. Morgan Busch)
OPNAV (OP-102X, Attn: Mr. Merlin Malehorn)
(OP-942D, Attn: Mr. Stan Greenblatt)
COMNAVSURFPAC (Code N73, Attn: LCDR Glivings)
CO USS GRIDLEY (CG 21)

Copy given to Frank M.

DEPARTMENT OF THE NAVY
USS GRIDLEY (CG-21)
FPO, SAN FRANCISCO 96601

FS/CG21/03:1c
3900
Ser 302
12 SEP 1978

From: Commanding Officer, USS GRIDLEY (CG-21)
To: Commanding Officer, Navy Personnel Research and Development Center, San Diego, California 92152

Subj: Automated Shipboard Information Management System (ASIMS) Status Report; submission of

Encl: (1) ASIMS Status Report for 1 Nov 77 to 31 Jan 78
(2) (SC) Listing of ADP supplies received from and returned to NAVPERSRANDCEN from 1 Nov 77 to 31 Jan 78
(3) (SC) RDOS System Teletype Message Listing from 1 Nov 77 to 31 Jan 78
(4) (SC) BASIC Accounting File (BASIC.AF) Listing
(5) (SC) Neptune World Wide Moving Shipping Document for IBM 029 Keypunch dtd 27 Dec 77
(6) ASIMS Report Generation and CII Student Utilization Summary for 1 Nov 77 through 31 Jan 78
(7) (SC) 64 Student Record Images (Completions and deletions)
(8) (SC) CII Student Progress Report dtd 1 Dec 77
(9) (SC) 3 GDC Course tests, Form A (2 pre-test and post test answer sheets)
(10) (SC) CII Examination Statistics
(11) (SC) CII Audit Trail Listings
(12) (SC) GDC CII Change Records and Post Test Session Student Record Images from 1 Nov 77 to 31 Jan 78
(13) (SC) Data General Corp. Field Service Reports dtd 7 Nov 77, 9 Dec 77, 5, 24, 27 Jan 78
(14) Summary of NOVA 1200 Computer System Equipment History
(15) (SC) ASIMS Log No. 5 for 29 Jul 77 to 25 Jan 78

1. Enclosure (1) is provided as a status report for the development and operation of the Automated Shipboard Information Management System (ASIMS) aboard GRIDLEY. Enclosures (2) through (15) are provided as detailed information for project test and evaluation purposes.

2. Utilization of the ASIMS aboard GRIDLEY during this evaluation period, 1 November 1977 through 31 January 1978, has resulted in more effective management of personnel and material resources as well as reduction of clerical effort required to compile and produce documents now printed on the NOVA 1200 computer system. Events this evaluation period have impacted heavily upon the time available for the ASIMS to service GRIDLEY, e.g., temporary loss of DP3 HAAS, homeport change to Long Beach, California for overhaul, movement of the NOVA 1200 ashore, and procurement actions associated with installation of the Versatile Training System (DEC PDP 11/60 computer system). These events have been disruptive but never prevented the ASIMS from meeting its primary commitments. The Computer Integrated Instruction (CII) was used extensively throughout November 1977.

Use of the CII was discontinued during December's holiday leave period and the commencement of GRIDLEY'S overhaul period in January 1978. CII is currently on line and available for student interaction and will be utilized to train the GRIDLEY crew in General Damage Control when the overhaul period has elapsed suffiently to allow a managable work and training schedule. Applications described in previous reports have continued to be used and new ones implemented or are planned, i.e., Guage Calibration System, ROH Suplemental Work Summary System. A summary of reports distributed during this evaluation period and of student usage of the CII in General Damage Control is contained in enclosure (6).

3. Enclosure (13) reflects the maintenance performed on the NOVA 1200 computer system during this report period. Enclosure (14), prepared jointly by NAVPERSRANDCEN and GRIDLEY, contains an historical summary of the system's reliability and failure rate throughout the RDT and E period aboard GRIDLEY. Although it is not the purpose of the test and evaluation project to evaluate the system hardware, it is deemed appropriate to state that the system, an off-the-shelf commercial grade computer was 91% reliable. Most of the down time was due to waiting on arrival of maintenance contract personnel or for parts on order. Actual repairs dealt with either parts replacement or minor adjustements. Few equipment failures resulted in the total system being down, but did degrade operating capacity, e.g. inoperable cassette tape units, line printer, files disk, and terminals (CRT).

4. Throughout this evaluation period, extensive interaction between GRIDLEY ASIMS personnel and NAVPERSRANDCEN staff has facilitated a smooth and beneficial RDT and E effort. Space has been dedicated ashore in the ASIMS Computer Center for a student Learning Resource Center (LRC) and is presently available not only to CII students for study and on-line testing but also to the ADP users for updating of data bases and information retrieval. GRIDLEY welcomes the opportunity to be a part of the RDT and E of a Shipboard Learning Resource Center both during and after the overhaul. Courses related to the "BT" and "MM" ratings will be of particular value to GRIDLEY during the second half of the overhaul period and during the post overhaul period. The data processing services provided by the ASIMS has been valuable to GRIDLEY during the overhaul period thus far. The LRC should be a significant asset in preparing and training the GRIDLEY crew for her light-off examination and post overhaul OPPE when the appropriate engineering training has been provided.

W. STOUFFER

Copy to:
CNO (OP-942) (Less Encl (2) - (5), (7-13) and (15))
COMNAVSURFPAC (Less Encl (2) - (5), (7-15) and (15))

ASIMS Status Report From 1 November 1977 Through 31 January 1978

Ref: (a) NAVPERSRANDCEN ltr Ser 11 of 6 JAN 1978

1. The following events are deemed significant to the Test and Evaluation of the ASIMS and are reported in summary in the interest of bravity:

a. 1 November 1977. RADM MILLER, COMCRUDESGRU ONE, toured system and received ASIMS briefing.

b. 3 November 1977. LCDR LAIDLAW, NAVPERSRANDCEN and civilian personnel representing Human Factors Research, Inc., toured ASIMS to observe data base entry procedures.

c. 4 November 1977. ADP Officer duties defined and LTJG MYERS designated.

d. 9 November 1977. NAVPERSRANDCEN representatives aboard GRIDLEY to administer CII Examinations, Form "A". LCDR DOLLARD, NAVPERSRANDCEN, directed GRIDLEY's CII Training Official to discontinue administration of CII pretest and post test, Form "A", examination.

e. 12-23 November 1977. DPCS PHARR on TAD orders to NAVPERSRANDCEN and NWC, China Lake, California in conjunction with Versatile Training System (VTS) (DEC PDP 11/60 and vehicle procurement). CII in GDC utilized by reserve personnel on board GRIDLEY for training. A reserve OS3 served as CII Training Official.

f. 24 November 1977. DPSN Raymond HAAS transferred to NTC, San Diego, FFT FLTCOMBATDIRSSACT. DPSN HAAS' orders modified by BUPERS message dtg 010755Z DEC 77 to report to NAVPERSRANDCEN for duty vice FLTCOMBATDIRSSACT.

g. 8 December 1977. GRIDLEY's Supply Officer, LCDR GONZALES, requested that Data Processing establish a Supply Requisition Status System to be used during ROH vice SFOMS Supply Requisition System. Commenced building Supply Requisition Data Base on 21 December 1977 and printed first sample report on 23 December 1977. GRIDLEY's Supply Requisition Status System was implemented under the Command Management System (CMS). Update and report generation Programs written in Data General Corp. BASIC by ship's Data Processing Technicians are used to provide full update and report capability. This ASIMS service if procured from a civilian contractor is estimated to have an annual cash value/savings of approximately $10,000 for a CG-16 class ship.

h. 9 December 1977. GRIDLEY's Weapons Officer, LCDR SHANNON, requested implementation of a Gauge Calibration System. Used CMS to build and update the data base. Printed first Gauge Calibration Report on 14 December 1977.

Enclosure (1)

i. 12 December 1977. Data General Corporation Technical Representative destroyed data stored on primary system and files disk while performing remedial maintenance. All files reconstructed by 20 December 1977.

j. 19 December 1977. IBM 029 Keypunch, ser. no. B6362, packaged by IBM Technical Representative for return shipping to IBM Corporation Unit shipped on 27 December 1977 (see enclosure (5) of basic letter).

k. 21 December 1977. DPSN HAAS commenced working on GRIDLEY on loan from NAVPERSRANDCEN (took leave 23 December 1977 to 3 January 1978). DPCS PHARR on leave from 23 December 1977 to 3 January 1978.

2. The following events are related to relocation of the NOVA 1200 Computer System ashore and procurement of the DEC PDP 11/60 Computer System/ VTS Training Device subsequent to commencement of GRIDLEY's ROH, Long Beach Naval Shipyard:

a. 9 January 1978. GRIDLEY arrived Long Beach Naval Shipyard, Long Beach, California for overhaul.

b. 10 January 1978. A 10' X 40' trailer assigned NAVPERSRANDCEN by Long Beach Naval Shipyard to house NOVA 1200 Computer Center and Student Learning Resource Center. NOTE: Could only operate NOVA 1200 Computer System intermittently during period 10-23 January 1978 due to inadequate electrical power and air conditioning in shipboard Computer Room (ECM 1).

c. 12 January 1978. Action taken by NAVPERSRANDCEN to purchase two air conditioning units for installation in trailer designated to house ASIMS in Long Beach Naval Shipyard. NAVPERSRANDCEN Representative advised by GRIDLEY Operations Officer of actions required to restore ECM 1 (05-90-0-Q) to condition existing before installation of ASIMS NOVA 1200 Computer System. DPSN HAAS photographed vehicle at Overland Industries, Orange, California being constructed to temporarily house DEC PDP 11/60 Versatile Training System during GRIDLEY's overhaul period. Visit also made to Data General Corporation, El Segundo, California to establish initial contact and arrange for maintenance service. DPSN HAAS also visited NAVPERSRANDCEN, San Diego, California to obtain advance copy of reference (a).

d. 17 January 1978. DPCS PHARR took possesion of trailer No. 11, Long Beach Naval Shipyard, Long Beach, California for NAVPERSRANDCEN. GRIDLEY's Data Processing Technicians began moving furniture and ADP supplies into trailer. Secured NOVA 1200 due to excessive heat in ECM 1 aboard GRIDLEY and continued packing of ASIMS materials and ADP supplies in preparation for moving system ashore.

e. 18 January 1978. Completed moving all ASIMS materials and supplies ashore with exception of computer system and peripherals.

f. 23 January 1978. NAVPERSRANDCEN visit request dtd 20 January 1978 for Data General Corporation Technician Representatives submitted to Long Beach Naval Shipyard Security Office. Copy of NAVPERSRANDCEN purchase order for air conditioning procurement submitted to PWC, Long Beach Naval Shipyard.

g. 24 January 1978. Data General Corporation performed pre-move checks of NOVA 1200 Computer System. Long Beach Naval Shipyard representative aboard GRIDLEY in response to reference (a) to survey and establish what assistance they were to provide ASIMS during ROH.

h. 24-26 January 1978. Data Processing Technicians relocated NOVA 1200 Computer System to Trailer Number 11, Long Beach Naval Shipyard and reassembled.

i. 27 January 1978. Data General Representatives performed post move inspection and repaired all units needing service. NOVA 1200 Computer System fully operational.

3. The CII course in General Damage Control became inactive during the 1977 December leave period. Total enrollment as of 31 January 1978 was 325 students 132 currently enrolled (82 completed, 111 disenrolled at various stages following seperation, transfer, or qualification in DC-2 PQS under traditional methods). The attrition rate is attributed to the "shotgun" approach used to select students and does not reflect the course difficulty level or availability of students or courseware. Twelve of the students dropped from the course were either Officers or Chief Petty Officers who had enrolled only to evaluate the lesson material. Thirty-two students disenrolled from the course after qualifying in DC-2 PQS using conventional procedures. Those students, for the most part, were forced to complete their requirements during periods when the CII Training Official was on TAD or leave in order to satisfy the six months within reporting completion requirement. The remaining students disenrolled were either separated or transferred. Although not a part of the original research design, it had become evident at the beginning of the project that student module or lesson completion rate was influenced by the amount of attention given to student progress through the CII General Damage Control course. Data to measure and confirm this phenomenon were gathered from two periods. One period was during GRIDLEY's deployment (June to December 1976) where students interacted with the CII system at their own pace to meet the ship's General Damage Control (DC-2) requirements. The second period (March to August 1977) was characterized by direct command involvement to cycle students into and through the CII course. This "command managed" phase also used a computer generated report which contained summary student progress information sorted by total ship, department, and division. The data for this management tool was collected automatically during CII. Overall, the CII was found to be an effective training vehicle for General Damage Control.

Enclosure (1)

Automated Shipboard Information Management System (ASIMS) Report Generation and Computer Integrated Instruction (CII) Student Utilization Summary for 1 November 1977 through 31 January 1978.

SHORT TITLE	LONG TITLE
AUDIT	CII Audit Trails
BASIC.AF	BASIC Accounting File Record
CALRPT	General Purpose Electronic Test Equipment Calibration Report
CIISTATUSRPT	CII Status Report
DUSECTRPT	Duty Section Report
ENLCROSSREF	Enlisted Personnel Cross Reference
GAUGERPT	Gauge Data Base Report
INTRPT	Intelligence Data Base Report
LEAVERPT	Enlisted Personnel on leave Report
LOGRPT	Deficiency Log Report
MUSTERRPT	Muster Reports
NEWDUTRPT	New Duty Section Reports
PA (ENLDT)	Print all Elements of the Enlisted Personnel Data Base
PAOLAB	Public Affairs Office File Label Print Programs
PAORPT	Public Affairs Data Base Verification Report
PNROST	Enlisted Personnel General Purpose Roster w/SSN
ROSTER	Enlisted Personnel General Purpose Roster w/o SSN
SPECPAYROST	Special Pay Verfication Roster
SUPPLYRPT	Supply Data Base Report

FS/CG21/03:1e
3900

NAME	NOV	DEC	JAN	TOTAL
AUDIT	1	0	0	1
BASIC.AF	2	0	0	2
CALRPT	2	6	5	13
CIISTATRPT	4	3	0	7
DUSECTRPT	0	10	0	10
ENLCROSREF	0	2	0	2
GAUGERPT	0	11	4	15
INTRPT	2	4	0	6
LEAVERPT	8	8	0	16
LOGRPT	0	5	0	5
MUSTERRPT	61	60	52	173
NEWDUTRPT	15	18	25	58
PA (ENLDT)	0	1	2	3
PAOLAB	0	1	0	1
PAORPT	0	4	0	4
PNROST	9	15	32	56
ROSTER	8	18	8	34
SPECPAYRST	0	2	4	6
SUPPLYRPT	0	5	9	14
	112	173	141	426

CII Utilization				
Mods. Compl.	197	4	0	201
Tests Taken	296	6	0	302

Table A-2. Total summary for ASIMS Report Generation and CII Student Utilization for November through January 1978.

SUMMARY OF NOVA COMPUTER SYSTEM EQUIPMENT HISTORY

(This history covers the period between March 1976 to August 1977). The NOVA 1200 is an off-the-shelf commercial grade general purpose computer system (non-militarized). The system was installed aboard USS GRIDLEY (CG-21) without extensive modification. Two blower fans were added to the Central Processor Unit cabinet (one intake and one exhaust) to facilitate air circulation. To provide the system protection from severe shock, high frequency vibration and structure borne noise, the CPU cabinet was mounted on four Barry Controls shock mounts No. C-4300-20 with one top mounted stabilizer No. 21335-5 (Barry Controls is a division of Barry Wright Corp., 700 Pleasant St., Watertown, MA 02172, telephone (617) 923-1150). The CPU cabinet contained in addition to a backup CPU (never utilized except for spare parts during emergency repairs), a Data General Corporation. (GDC) cassette tape unit, a DGC disk power supply unit, and two Diablo disk drives. The Data Products 2410 line printer was mounted on four Barry mounts No. C-2090-T6. The terminals (CRT), Mohawk card reader and Teletype were mounted on Barry cylindrical mounts No. A22-041.

An inventory of spare parts was inherited when the system was transferred from the USS DAHLGREN to the USS GRIDLEY (CG-21). An attempt to update and maintain the inventory was not necessary as the maintenance was performed by Data General Corporation under a parts and labor contract. What spare parts were available were seldom used as most equipment failures were related to components not carried with the exception of logic/control cards and spare hammers purchased for the Data Products 2410 line printer. Input/Output boards, core memory boards, and power supply units available in the backup CPU were used for emergency repairs when at sea. These were later repaired by Data General and/or replaced. No attempt was made to protect the system from electronic emissions.

The following is a summary of system equipment history aboard the USS GRIDLEY (CG-21):

Central Processing Unit (CPU)

The CPU had a reliability of .928 and a downtime percentage of approximately 7%. CPU malfunctions were limited to one bad 8K core memory board, a power supply failure, and minor problems with various peripheral I/O circuit boards. Most repairs were made on board ship by Data General maintenance technicians and involved only replacement of parts. Approximately 5% (25 days) of CPU downtime was attributed to waiting for a maintenance technician to be summoned and transported to GRIDLEY while the ship was deployed in the Western Pacific during 1976. Several times the CPU became inoperative due to dirty read/write heads on the disk drive units or to faulty I/O device connections (e.g., loose or shorted wire to a remote video display terminal). These problems were corrected as they occured by the system operators.

Enclosure (14)

Teletype Computer Consule (TTY)

The TTY had a reliability of .951 (5% downtime). The TTY was rebuilt in 1975 by NAVPERSRANDCEN due to being damaged by spray paint while installed aboard DAHLGREN. The paper tape punch/reader never operated properly while on board GRIDLEY. A nylon gear had to be replaced in October 1976. Minor lubrication and PMS adjustments were occassionally performed by the Data General maintenance technicians.

Disk Drive Units (2)

One disk drive unit had a reliability of .998 (1% downtime); the second unit had a reliability of .954 (5% downtime). Significant malfunctions were:

° Damaged logic control board caused by electrical arcing on the board. Unit was replaced with a factory spare and repaired at a Data General repair depot in about 20 days.

° Phasing and sequence timing difficulty occurred twice and was repaired, with minor adjustments by Data General maintenance technicians.

° Dirty read/write heads which caused parity errors and CPU shutdown occurred twice. Heads were cleaned by system operators using an alcohol base cleaning fluid and a lint free tissue. This became a regular semi-annual PMS check. Disks collected dirt during initial system installation in 1976 due to aluminum welding work in the computer room. Smoking also contributed to cause dirty read/write heads and was prohibited in the computer space in early 1977.

° Several fuzes were blown and replaced.

Cassette Tape Units (CTU)

There were two cassette tape units, each containing three independent cassette tape drives. One CTU had a reliability of .88 (12% downtime); the other .366 (63% downtime). The CTUs were found to be of poor quality construction and experienced a high casualty rate. One CTU was eventually surveyed "beyond economical repair" in early 1977 after ten months of intermittent operation. The other CTU had either one or two of the three cassette tape drives inoperative. Most problems with the CTUs involved worn or broken parts, such as bushings, brakes, fans, chips, diodes, and transistors. These units were generally not repairable on board ship due to inexperience by the maintenance technicians on CTU repairs and/or lack of parts. When a CTU did operate it required frequent adjustments and cleaning by the system operators.

The non-availability of the cassette tape units or drives resulted in an inability by the system operators to build backup files, maintain historical data, conduct diagnostics, and add/transfer data to and from the disks. Extra disk space had to be allocated to perform these CTU functions. Even when the CTUs were operating, system operators were discouraged to use the cassette tapes for data storage because of their limited capacity (40K words) and long run time (up to 10 minutes).

Line Printer (132-character)

The 132-character line printer had a reliability of .820 (18% down-time). This printer experienced several malfunctions as follows:

° On six occassions control and logic circuit cards had to be replaced or repaired due to possible equipment overload. On site soldering or chip repairs were made by Data General maintenance technicians or by a system operator receiving directions from such technicians via telephone.

° Four carriage control milar tape ribbons which control printer paper paging had to be replaced and/or realigned. This repair was done by either a maintenance technician or a system operator.

° Four printer hammers had to be replaced by a maintenance technician.

° A washer dropped into the printer while civilian contract personnel were installing equipment above the printer and destroyed two magnetic strips and five printer hammers. Maintenance technicians made all necessary repairs.

° A rubber printing drum belt broke and was replaced by a maintenance technician.

° Other minor problems involved adjusting the drum timing ring, repairir a magnetic backing strip, and replacing a deteriorated wiring harness and worn wires. These repairs were accomplished by a maintenance technician.

Line Printer (80-character)

The 80-character line printer had a reliability of 1.000 (0% downtime). This printer was rebuilt in 1975 by NAVPERSRANDCEN. While on GRIDLEY it was used as a backup printer and operated about 18% of the time. No PMS nor maintenance of any type was performed on this printer. A gravity switch which caused the printer to be turned off during heavy rolling at sea was taped by the system operator to prevent printer shut-off.

Card Reader

The card reader had a reliability of 1.000 (0% downtime) and was used less than twenty times to read cards. An operating software problem, which was not resolved until mid-1977, caused one card character column not to be read.

Video Display Terminals (CRT)

There were four CRTs in the computer system on GRIDLEY. Since the CRTs were interchangeable their reliability was 1.000, .998, .949 and .485 (0%, 1%, 5% ad 56% downtime), respectively. For example, at least one of the CRTs was inoperative 56% of the time. CRT malfunction included a faulty shift key, dirty or corroded aluminum contacts, bad I/O boards, faulty key board characters, and loose of shorted CRT connector plugs. Even if a malfunction was considered minor or intermittent, such as a bad character display for one character, the CRT was logged out of commission. The CRT with the bad shift key took 150 days to be repaired at a Data General repair depot.

APPENDIX B

USS KITTY HAWK (CV 63), INFORMATION PROVIDED

This appendix contains documentation provided during a visit aboard the USS KITTY HAWK (CV 63), the contents of which are as follows:

- Description of the LINDA System
- LINDA Performance Log
- Existing LINDA Administrative Programs

Encl (1) Typical Information Displays Provided by the System

BACKGROUND

The LINDA system is an alpha numeric electronic display system based on technology and techniques which are used commercially. It was originally funded from the Naval Weapons Center (NWC) discretionary funds to demonstrate, on an operating ship (USS KITTY HAWK), the utility of electronic data display (EDDS) at the Air OPS Flight Deck Control and Pri-Fly work stations. The basic difference with other proposed EDDS's is that the LINDA system uses a mini computer with a time sharing system software which allows several terminals to be operated at the same time. Terminal usage is controlled by the operator so that he may view any of the displays available to his work station as required by the work situation. Privacy of any display can be obtained by programming restrictions to a users account.

The program was given a go-ahead in January of 1977 . Equipment was ordered and mostly delivered prior to installation during the week of 8 May 1977. Software was written originally to emulate the grease boards which were being used by the ship at that time. It had to be rewritten as ships personnel became more familiar with the capabilities of the system and as laboratory personnel became more familiar with the operating conditions and the users requirements.

A "display only" terminal, for use on the bridge, was included in the original system. This has led to an expansion in the use of the system beyond that originally envisaged. The capability of the system to continue to expand into several areas without slowing down its response time continues to be impressive. This expansion has been possible because of the use of higher order languages (HOL), which allows an individual to write programs for the system without extensive programming training. Thus, several programs now being used by the ship are user originated. The use of the LINDA system is currently being studied by NAVDAC with respect to future shipboard ADP system designs.

The ability of the USS KITTY HAWK to deploy with commercially available unmodified equipment and to operate through the complete work up and deployment of an online aircraft carrier with a minimum of downtime has been illuminating. Especially, since this task was undertaken by the ship with no additional staffing, training or maintenance equipment.

INSTALLATION

The installation took place the second week of May 1977. Three NWC people were involved for 5 days with aid from ship's company. Eight-conductor shielded cable was used to wire-in the consoles. Lengths of up

to 800 feet are currently being used with no adverse effect. The system came up within minutes of receiving ship's power and the consoles came online as their cables were connected.

From May through October the system was located in the V-2 Division Office. This is a non-airconditioned office about 6 x 11 feet. It is located starboard, amidship on the Ø3 level. In November, the system was located in the NATO Seasparrow Room which is very airconditioned. The area occupied is about 10 x 15 feet. This is located starboard, aft on the Ø2 level. The reinstallation took place enroute to Hawaii from San Diego. The system was down for about 48 hours to accommodate the relocation of the CPU, UPS, and DEC Writes and the System Console.

OPERATION

PERSONNEL

From initial installation until deployment, the NWC provided one programmer and one system manager. Ship's company in Pri-Fly, FDC, AIR OPS and the bridge were involved solely as operators of the existing programs. At the time of Deployment, the NWC systems manager left the program and the ships training officer was designated LINDA liaison officer. The USS KITTY HAWK also agreed to provide maintenance costs as needed. Enroute to Japan, the NWC programmer provided extensive software training to 6 persons from ships company. One of these persons was assigned as system manager. Upon arrival in Japan, the NWC programmer returned to NWC. The ships programmers continued work on their separate programs.

In Hong Kong the system required service from DEC (system manufacturer). At this time, the ship had no personnel allocated for hardware support. World wide field service from DEC was used as needed. After Hong Kong a DP1, from the TSC group on the USS KITTY HAWK, was asked to begin support of the LINDA hardware. There was no training provided for the hardware support person. His experience with other digital computers proved partially adequate to provide support for the LINDA system. During the mid-cruise visit by NWC an additional ships programmer was brought up to speed on the system by the NWC programmer.

Upon return to CONUS, the ship effectively assumed all operational responsibilities of software and hardware support. NWC is now acting in an advisory capacity to the ship concerning the system, its usage and its growth.

SCHEDULING

The system online schedule is 24 hours per day. This allows the following:

1. Ship's programmers to write and test code any time. Their work schedules are so varied that the constant availability of the LINDA system has allowed effective usage of their spare time.

2. Ship's STATUS programs are updated and viewed around the clock. The operation of the ship dictates that this service be available.

SYSTEM DESCRIPTION

HARDWARE

This system uses the UNIBUS architecture inherent in the digital equipment PDP-11 family of processors. The system consists of the following:

1. The PDP 11/34 is an advanced 16 bit CPU. It can address up to 128K word of memory and 4K words for device registers. Its architecture includes vectored interrupts, single/double operand instructions, DM access to devices, stack processing and asynchronous operation with peripherals. All address and data switches have been eliminated since their function is performed by a mini ODT ROM callable by the system console at start-up time. There have been no failures in the CPU.

2. The 64K words of MOS memory attached to the CPU is allocated in 3 parts.

   (1) The RSTS-E monitor resides in 18K words
   (2) The BASIC-PLUS interpreter resides in 14K words
   (3) User space is 32K

The monitor and BASIC do not swap-out to the disc swap file since their services are frequently required. User programs may be made non-swappable, but this may degrade other user program response times. In June and July of 1977 two memory failures occurred. Long exposure to temperatures above 90°F probably contributed to these failures.

3. DEC RK05 discs provide the mass storage for the system. There is a 1.25 M word system disc and a 2.5 M word data disc. The following files are contained on these discs.

   (1) System START-UP and SHUT-UP programs.
   (2) System program swap files
   (3) System utility programs
   (4) Application programs
   (5) Application data files

Files (1), (2) and (3) are located on the system disc. Files (4) and (5) are distributed on the system and data disc. All files have an associated account number and password to restrict or enhance user accessibility. There are 2 classes of accounts: NON-Privileged: All application programs are in this class. Privileged: Allows system manager or advanced programmer to seriously alter system parameters.

One disc motor failed in September 1977 due to unknown causes. Repair was performed, no data was lost, and there have been no failures since that time.

4. The DEC writer II hard copy is a complete console with paper used as the printing medium. It is used for program listings, system status, data dumps and inter-console communication. A power supply failed in February 1978. Ships company repaired the power supply. There have been no other failures.

5. The 16 port asynchronous serial mutliplexer is an interface to the system which communicates with all user CRT consoles. This communication takes place on cable installed from the system SITE to each of the console sites. There have been no failures in this subsystem.

6. The ADM-3 CRT consoles are alphanumeric entry and display devices. The I/O rate chosen is 4800 baud. Other standard rates are available. These consoles use upper case only, non-programmable cursor, and equal input/output rates. Of the 13 CRT consoles on the system, there were minor problems with 3 of them. All were repaired by ship's company.

7. A 3 KVA uninterruptable power supply (UPS) was used to solve the problem of intermittant power on the ship. The ship's 110V 60 Hz power supply charges the UPS batteries. The DC voltage from the batteries drives a power inverter which outputs 110V 60 Hz. The system can provide up to 26 amps at 110V 60 Hz for 20 minutes. The central site portion of the system requires only 10 amps of power. The longest power outage experienced was 40 minutes with no interruption of service. The UPS also buffers very short (1 to 5 sec) power outages superbly. The inclusion of the UPS relieved the RSTS-E monitor of all responsibility for fail-soft characteristics. The equipment has worked flawlessly throughout the past year.

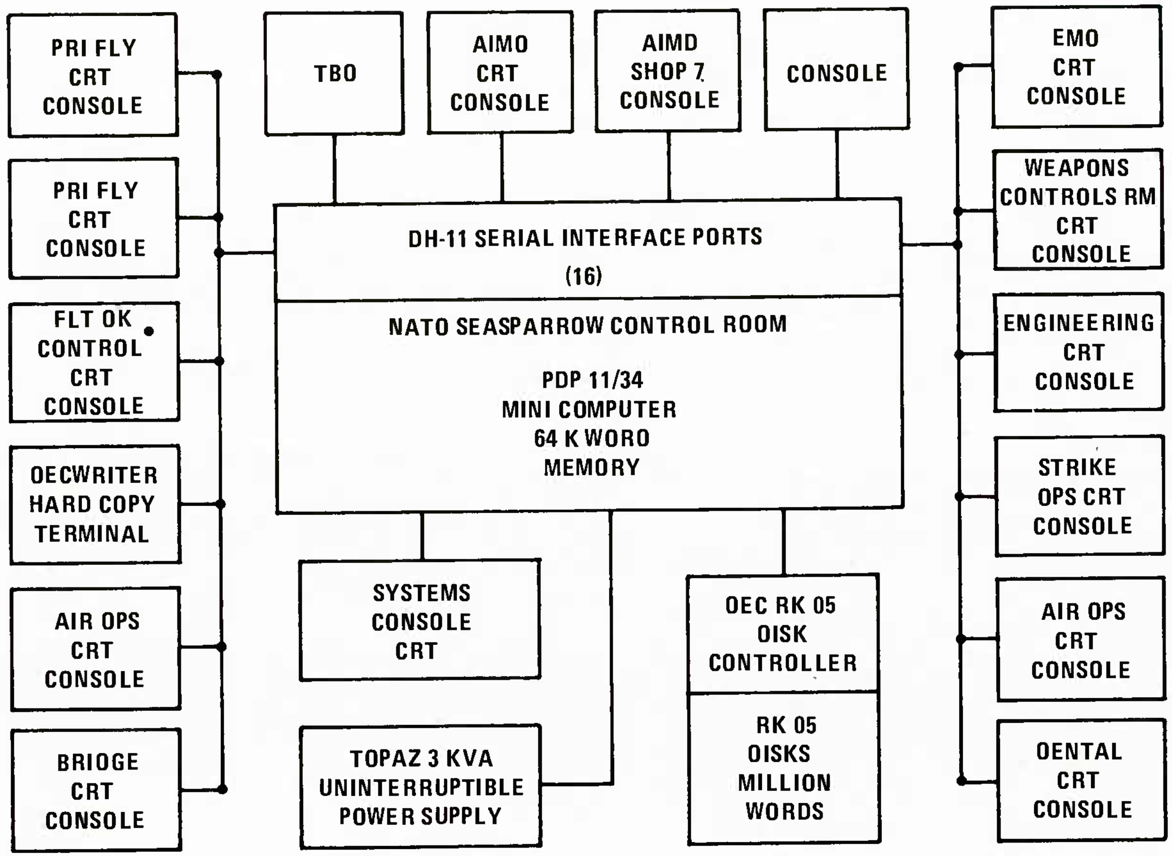

Figure B-1. Linda System

RECOMMENDED HARDWARE MODIFICATIONS

1. The data cables connecting the various consoles to the CPV were simply twisted pair shielded cables. Throughout the year several splices were made in some of the cables which may have allowed some noise to enter the data lines. The system would attempt to process that noise as data. The input rate to the computer was set the same as the output rate (this restriction was imposed by the particular console we used) which meant if sufficient noise entered the data lines it would enter the processor at a very high rate (4800 baud). Accordingly, the system response to other users would begin to degrade. Two precautions can be taken: (1) assure satisfactory shielding and terminating of cables and (2) split the baud rate so input to the CPU is about 300 baud independent of the output rate. In the event of noise entering the system, it would be processed much slower with negligible impact on the other users.

2. The switches on the disc's (rocker arm style) were accidently hit, shutting the system down occasionally. This can be easily remedied by providing switch cover plates or moving them to a more remote location where they cannot be hit by people standing around the control.

3. The performance of the UPS was outstanding. We encourage its inclusion in any digital computing system where intermittant power is probable.

4. A secure mounting of all power connectors is recommended as we experience the disc power connector vibrating loose, shutting the system down.

5. A temperature restriction of 85°F should be imposed since we suspect our memory failures were due to temperatures in excess of 90°F.

6. A console somewhat better engineered than the ADM-3 is recommended. The problems we did have with the ADM-3 all related to poor performance of its power supply. There are numerous choices available on the market today.

7. UPS service is recommended for the prime operating consoles. The current system has UPS service on the computer only. If power is interrupted, the computer is protected but an unprotected console will appear dead. At the instant of power resumption the terminal service is restored. Complete protection during power outages is recommended, as the work stations involved affect the operation of the flight deck and the aircraft.

SOFTWARE

1. RSTS-E version 6A time sharing system software provides the following capability:

(1) Account-password log-in structure.

(2) <u>Program swapping file</u> - the swapping file will allow 20 users to have 16K word programs each. All of the programs will not fit in the 32K word of memory allocated for user space, thus, the system will swap out programs to the disc swap file. Program activity, console activity, system activity and program priority dictate swapping procedures. Current program sizes are from 3K to 11K words. Typically, 5 programs are resident at a time in memory. Even with 12 programs online, system response is only 1-2 seconds, because most programs are waiting for console data commands.

(3) System utility programs including a file management program, system manager program, system status program, a very powerful test editor and several software debug programs.

2. BASIC-PLUS programming language interpreter.

(1) Up to 16 thousand word program size.

(2) Virtual data files up to size of disc.

(3) During July 1978, the system was upgraded to RSTS-E version 6C and BASIC-PLUS II interpreter.

3. Application Programs

(1) Data entry for launch, flight status and recovery of aircraft.

(2) Data entry for all aircraft operational status.

(3) Data entry for all department report programs.

(4) Data entry for CASREPS by mission area/

(5) Data retrivial for all data entered in programs 1, 2, 3, 4. A menu selection for retrived status programs is implemented because of the lengthy number of status programs.

(6) Data base weapons inventory and accounting program.

(7) SFOMS workload status program.

(8) Dental records program.

The original software programs developed at NWC during the period that material was being ordered and delivered consisted of emulating, to the extent possible, the data which was currently maintained on the status boards (grease boards) then in use. These programs were developed in conjunction with the Air Boss, the Handler and the Air Ops officer of the USS KITTY HAWK. The programs provided the following menu:

SIDE #	NAME	FLT ST	FUEL STATE	TIME OF FS	BT #	RECOVERY STATUS
100	SMITH	A	12.8			
101	HAMEL	A	1.30			
308	ROGERS	R	5.70	0917	18	
107	DYE	R	5.20	0915	16	T
203	BACKMAN	R	4.60	0918	16	FBWBT

FIXED HDGS

38 LINES OF DATA

BOTTOM LINES CONTAIN SIDE IN SEQUENCE OF RECOVERY

Figure B-2. Air Ops Electronic Grease Board.

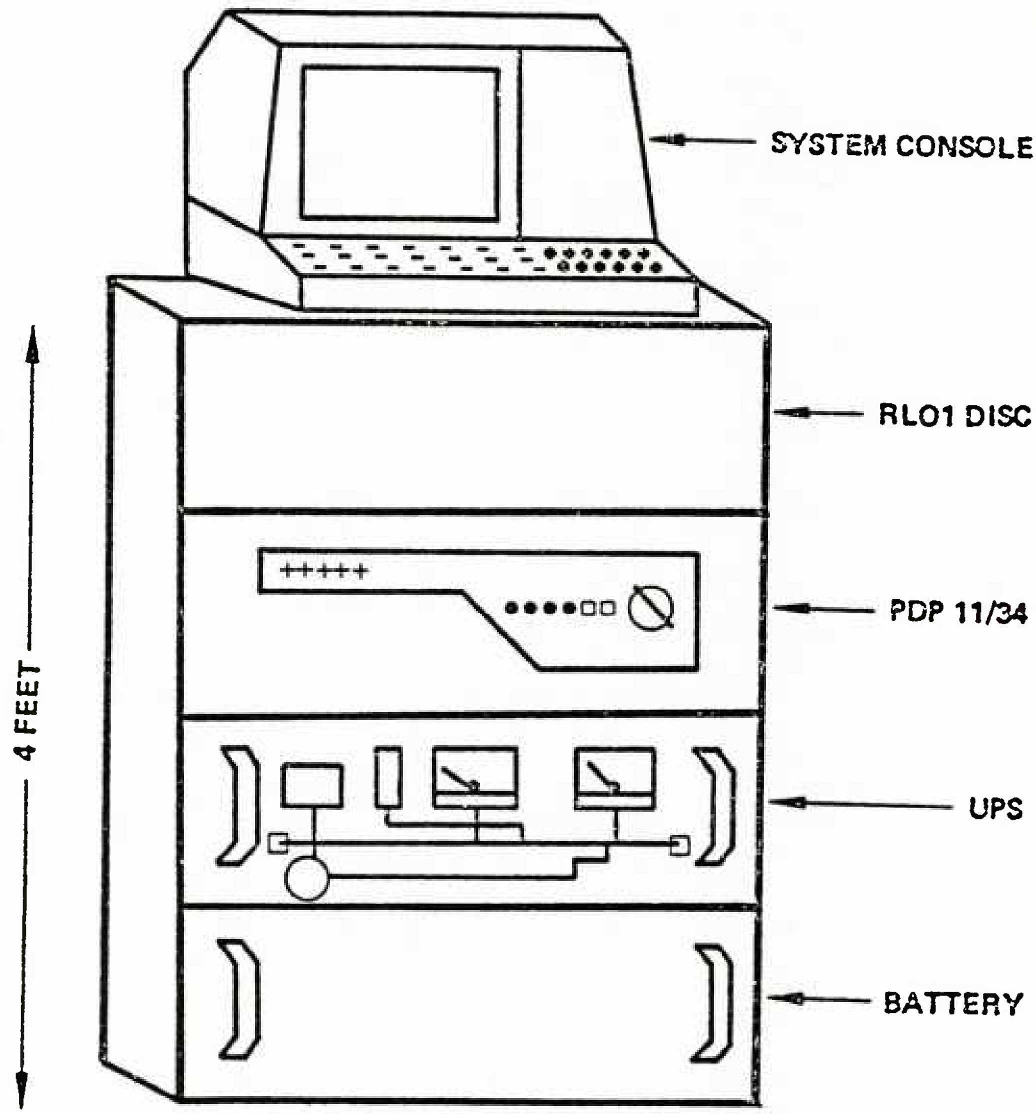

Figure B-3. Proposed equipment configuration.

(1) Strike Plan

(2) Launch

(3) Air Plan

(4) Recovery Plan

(5) A/C status file

At the request of the ship, Engineering Department Equipment Status Reports were added. This consisted of six pages of data on the status of equipment and data on the ships weight and balance. A synergistic effect was noted here, in that the catapult status report provided the information to determine the readiness of the catapults for launch. This reduced the number of calls required from pri fly to the Engineering Department for this data. Shortly after this status data was added to the system, request was made to include all departments on an equipment status file. A menu selection is used to retrieve status programs which currently consist of 85 pages. User status data is inputed through the nearest available terminal which means that several departments input data through one shared terminal such as the systems console located in the Sea Sparrow space.

Proposed Pri Fly System

The operation of the LINDA System for the past year has demonstrated the values and shortcomings of the initial system concept. The following description incorporates the worthwhile features and corrects the shortcomings found.

The system architecture and the specific selection of equipment proved to be an excellent choice. Several of the subsystems have been changed to reflect both newer technology and less expensive devices. The prime limitation imposed is to limit the console locations to work stations pertaining to Air Operations and Pri-Fly Control. The following is a suggested list of console locations:

(1) Pri-Fly

1 CRT for data entry

1 CRT for display to Air Boss

(2) Flight Deck Control

1 CRT for data entry

1 Electronic Display Board

(3) Air OPS

1 CRT for data entry

1 Electronic Display Board

(4) Bridge

1 CRT for display to C.O.

(5) Alpha numeric line printer location to be determined. This will be used to print reports relating to the data being collected.

As an option, other CRT's or display boards can be added to allow additional work stations to view the same data. The additional load on the system is neglible. Two work stations with extreme interest in viewing this data are Strike OPS and CVIC.

Programs

Two classes of application programs are suggested. The first related to air operations. Items of interest are

(1) Launch activity

(2) Airborne status of A/C

(3) Recovery activity

(4) Bingo and weather data

The second class of programs relate to aircraft status on deck. Items of interest are

(1) Airframe status

(2) A/C system status

(3) Remarks for down A/C

Much work has been done on the current LINDA System during the past year. With some expansion and refinement, the two classes of programs can be committed to usage as they are.

Maintenance Policy

The LINDA System was an austure experiment to demonstrate the suitability of a mini-computer supported time sharing system on a combatant ship. Much thought was given to maintenance, but little was accomplished. The actual policy was to operate the system until it failed. At the time of failure one of three sources would be sought to effect repair.

- NAVWPNCEN engineering personnel
- DEC field service offices if available
- Ship's company

All three sources were used. With the class of failures which occurred and the caliber of people utilized, the following maintenance policy appears satisfactory:

a. Training of ships company DS class technician approximately 6 weeks training at DEC and other vendors would be adequate for repair (to the module level) of any type failure. Spare parts kits to the 80%, 90% and 95% probability of repair are currently available. Diagnostic software to isolate failure modes and test repairs is also currently available. With trained ships company, spare board kits, and diagnostics all the essentials of a sound maintenance policy at present. Probably-failed boards should be returned to the manufacturer via a central maintenance facility. Most manufacturers repair failed boards at a fixed cost per board. Since the frequency of failure is on the order of weeks to months, a large on-hand inventory is not required.

In addition to the ships support, DEC has many field service offices around the world, especially key ports on the Far East and Europe. They are always available for assistance or advice on a per call basis.

The experience on the LINDA System demonstrates that maintenance service will seldom be needed. This implies that this responsibility should be a collateral duty to the maintenance personnel and thus will not impact the manning level of the ships affected.

Table B-1. Maintenance Log.

31 May 1978

1630	DLIIW board replaced by DEC cost 516.44. KBØ changed to RS2 operation. System up.

1 June 1978

0800	System hung, won't acknowledge keyboard input. When KBØ was turned on, ERRCPY was dumping info to KBØ. ERRCPY detached leaving system up for KBØ but down for other devices. System had lost terminal characteristics of other devices. Logged on acct 1, 2 and ran in system up with 2 ERRCPY jobs detached. So second job was killed.
1000	After it was noticed KB29 not transmitting KB29 works in HDX

2 June 1978

0800	System up

5 June 1978

0800	System up

6 June 1978

0800	System Hung. Could log in on KBØ but no where else. SYSSTAT normal. Reset power supply losses of ships power while adjusting swbds had tripped the reset). Bootstrapped computer system up; unable to transmit from any KB except KBØ:
0835	Reboot strapped; no change
0930	DSC Newman & DS1 Lineham removed each I/O port with no results. Rebotted and system came up normally.

7 June 1978

0800	System up.

8 June 1978

0800	System up.

9 June 1978

0800	System up after Ø745 crash caused by someone shutting down DIC3: During F' Div morning quarters.
2200	Restarted system to insure it was clean prior to the weekend.

Table B-1. Continued.

12 June 1978

0800 System up.

25 June 1978

1600 DECWRITER down. Computer is fine.

3 July 1978

0915 System up after 0745 crash caused by someone shutting down DK3 during Fox Division morning quarters

8 July 1978

1030 System down - restarted system normal.

25 July 1978

0900 System hung - restarted.

1000 System up

1400 System hung - restarted

1500 System up

26 July 1978

1300 System down. No power to boards for the system power supply.

27 July 1978

0800 Power restored to boards. Restarted system. System functions normally

6 August 1978

1500 System down due to loss of station shore power

7 August 1978

0800 Restarted system. Uninterruptible PP inverter down - loud ringing noise coming from inverter.

9 August 1978

1300 System down - 5 volt PP blown (H744) - no power to computer.

17 August 1978

1030 H744 PP installed. System up

Table B-1. Continued.

18 August 1978

0730 System crashed - restarted system.

1100 System hung - restarted system.

31 August 1978

0800 System shut down - lack of air cond

1 September 1978

0900 Restarted system

2 September 1978

1000 System shut down - lack of air cond

5 September 1978

0800 Restarted system.

15 September 1978

1900 Shut down system while SWBD #5 was cleaned. Joe was unable to restart system.

18 September 1978

0830 Restarted system.

23 September 1978

1000 Shut down system - lost air cond in Sea Sparrow. Room temp = 110°.

25 September 1978

0900 Air cond restored - restarted system

1. Existing Linda Administrative Programs:

a. Dental Program - Program lists all personnel attached to Kitty Hawk and is designed to expedite information retrieval in various areas of patient care. Specifically, patient accountability, patient recall for oral pathology screening exams, preventive dentistry recall and current patient health status are provided.

b. Engineering Program - Program includes main propulsion equipment status, major auxiliary equipment status, boiler water and feedwater condition, boiler status including hours since bottom blow, catapault status, engineering equipment which is OOC and ETI and fuel and water report. Data is arranged, such that all essential data is on one page and details are available on additional pages.

c. Electronic Equipment status and list of CASREPS by mission areas.

d. Weapons programs as follows:

(1) Weapons program 1 provides a quick and ready reference to ordnance accounting for the service and mission allowances and quantities on board. It also lists the latest transaction report dealing with a particular NALC for fast reference. Finally, this program provides percentages of allowances to allow for knowledge of when to reorder a given NALC.

(2) Weapons program 2 provides a quick reference for finding location of a given NALC or all the NALCS in a given location. It will provide Ordnance Accounting and Ordnance Control with a quick means of getting the locations of a particular type of ordnance for expeditious movement to aircraft for armament.

(3) Weapons program 3 provides the locations and quantity of a given lot. This program will enable Ordnance Accounting to quickly locate any lot for purposes such as suspension of a given lot, deletion of a lot, etc. Also, it will give all lots in a NALC and lots in a location for better accounting.

(4) Weapons program 4 provides Strike Operations and the Commanding Officer with a quick reference of what the ammunition status onboard is at any given time. This program drafts necessary information from program number 1 and is an output-only program.

(5) Weapons program 5 provides an inventory of all ship and squadron small arms. This will enable the Armory to gain quick access to locations and custodians, serial numbers of weapons, and various other factors.

(6) Weapons program 6 provides an ammunition inventory for the Marine Detachment. It will also provide a formatted printout for weekly MARDET Ammunition Training Reports.

e. The VF-213 squadron maintenance program is designed to establish a history file of aircraft maintenance source documents (VIDS/MAF) and provide programs for real time retrieval of selected data to enhance the maintenance management effort. The present capabilities are:

(1) VIDS/MAF data entry/update program and designated file on disc.

(2) Data extraction programs provide selected retrieval by:

(a) Outstanding discrepancies by work center.

(b) Discrepancies/corrective action by ACFT for last 10 flights.

(c) Work unit code (Review of individual system component reliability).

(d) NORS/NFE listing.

f. Eight O'clock reports - All departments have limited space under eight O'clock reports program for daily reports which include condition Yoke being set, sweepers held, major equipment status and space security inspections held.

g. Training - Program is presently incorporated into training department eight O'clock reports. Program lists all Surface Watch Officer candidates (116X designator), their PRD PQS points attained, percent complete, and a plus or minus PQS points figure indicating whether officer is ahead or behind schedule.

h. AIMD programs are almost complete, but since they are not presently in operation they are listed under planned/recommended programs.

2. Planned/Recommended administrative programs

a. AIMD proposed programs:

(1) Management of the Individual Capabilities Repair List (ICRL), which is a complex listing of some 13 to 14 thousand items for which the Kitty Hawk AIMD has a repair or support capability varying from calibration, to check/test, to complete repair. The listing is dynamic, in that constant part number, NIIN or entire line items change constantly. Maintaining such a file on call-up via computer terminal, to rapidly determine repair capability for items inducted into AIMD, would dramatically enhance the induction process.

(2) Management of Individual Material Readiness Lists (IMRL), similar to ICRL except it is the control document for equipage required to support the AIMD. Requires daily access, references, change and update of a 4000 item listing arranged by part number. Computer storage with selective call-up via remote terminals plus specified printout capability would vastly enhance management of this veritable "Monster" document.

(3) Management of the AIMD Technical Library Index and change file for rapid call-up and selective printout from a 5000 item file would permit accuracy and efficiency in management of this complex, rapidly changing AIMD Technical Library. Safety and maintainability would be directly enhanced due to positive management of some 20 satellite work center technical libraries and console change/update entries.

b. Training Program - This would be a list of all ship's company personnel with real time entry space provided to show progress/completion of Damage Control, 3-M, Watch Station, etc. requirements.

c. Retention/Advancement Program - A list of ship's company personnel with real time entry space provided to show TIS/TIR advancement requirements, course and PAR completion requirements and recommendation for advancement. Retention portion could show milestone dates for various career counseling interviews. The training, retention and advancement programs could probably be centralized into a single program.

d. NAVFORSTAT Program - Program would be written in required message format and would have real time entry space to update data as it changes.

e. Miscellaneous Programs -

(1) CASREPS listed by numerical sequence with real time entry space for status.

(2) Inventory of technical and classified manuals.

(3) Pre-expended bin inventory.

(4) Ready spares inventory.

(5) General Purpose Electrical Test Equipment inventory and status.

(6) Oustanding EMRM requisitions.

(7) Current OPTAR status.

(8) Facilities control patch panel display. This would be particularly importnant on a CV because of the many requirements for radios.

KITTY HAWK STATUS REPORTS

1	NAVIGATION
2	OPERATIONS
3	AIR
4	WEAPONS
5	ENGINEERING
6	SUPPLY
7	MEDICAL
8	DENTAL
9	DECK
A	AIRCRAFT INTERMIDATE MAINTENANCE
C	COMMUNICATIONS
T	TRAINING
X	ELECTRONICS EQUIPMENT
K	CASREP REPORT
W	AIRCRAFT MISSION ORDNANCE

Figure B-4.

CV-63 NAVIGATION DEPARTMENT
AS OF 12:35 18-FEB-78

CURRENT DATE 13-MAY-78 CURRENT TIME 14:26

EQUIPMENT PAGE 2

ITEM	UP	DOWN	REDCAP	REMARKS
HELM	X			
LORAN A	X			
LN-66	X			
MAGNETIC COMPASS	X			
MC SYSTEMS	X			
OMEGA	X			
PIT LOG INDICATORS	X			
RADAR REPEATERS	X			
RHMS	X			
RUDDER ANGLE INDICATOR	X			
RUNNING LIGHTS	X			
SATELLITE NAVIGATION	X			

Figure B-5.

CV-63 NAVIGATION DEPARTMENT
AS OF 15:56 19-FEB-78

CURRENT DATE 13-MAY-78 CURRENT TIME 14:27
EQUIPMENT PAGE 3

ITEM	UP	DOWN	REDCAP	REMARKS
SINS	X			
63 LIGHTS	X			
SOUND POWERED CIRCUITS	X			
STAR TREK PANEL	X			
STEERING ENGINES	X			
TACHOMETER	X			
WHISTLE	X			
REPORT	LTJG HERNANDEZ			

Figure B-6.

CV-63 OPERATIONS DEPARTMENT
AS OF 12:19 13-MAY-78

CURRENT DATE 13-May-78 CURRENT TIME 14:30
WEATHER FORCAST

ITEM	REMARKS
CLOUDS	PTLY CLDY, CHC RAIN SHWRS
VISIBILITY	7 MILES
WINDS	NE 15-20 KTS GUSTS TO 25 KTS
SEAS	HARBOR COND CHOPPY
TEMPERATURES	MAX 92, MIN 74

Figure B-7.

```
CATS AND ARRESTING GEAR
                              CV-63 AIR DEPARTMENT
                              AS OF 10:45   13-MAY-78

      CURRENT DATE 13-May-78      CURRENT TIME 14:32
                          CATS AND ARRESTING GEAR  -V2-

         ITEM                             REMARKS

   CATAPULTS                      1&2 NEEDS TO FIRE NO LOADS
   ARRESTING GEAR                 UP
   BARRICADE                      UP
   LENS                           UP
   PLAT                           AFT CENTER LINE CAMER DOWN
   MOVLAS                         UP
   CAT SURV SYSTEM                UP
   REMARKS
```

Figure B-8.

```
HANGAR DECK
                              CV-63 AIR DEPARTMENT
                            AS OF 10:45    13-May-78

         CURRENT DATE 13-May-78    CURRENT TIME 14:32
                                 HANGAR DECK    -V3-

         ITEM                   REMARKS

    ELEVATOR DOORS                UP
    DIVISIONAL DOORS              UP
    AFFF                          UP
    TAU                           UP
    SALTWATER                     UP
    SPOTTING DOLLIES (6)          2 UP
```

Figure B-9.

CV-63 AIR DEPARTMENT
AS OF 10:45 13-May-78

CURRENT DATE 13-MAY-78 CURRENT TIME 14:33
FUELS STATUS PAGE 1

ITEM	REMARKS
#2 PUMP ROOM	
SERVICE PUMPS	UP
TRANSFER PUMPS	UP
MTR/HAND STRIP PUMPS	UP/UP
FILTERS	UP
PURIFIERS	UP
#6 PUMP ROOM	
SERVICE PUMPS	UP
TRANSFER PUMPS	UP
MTR/HAND STRIP PUMPS	UP/UP
FILERTS	UP
PURIFIERS	UP

Figure B-10.

PROPULSION EQUIPMENT
PLANT STATUSA

CV-63 ENGINEERING REPORT
AS OF 12:32 13-MAY-78

CURRENT DATE 13-May-78 CURRENT TIME 14:39
PLANT STATUS

ITEMS	REMARKS		
BOILERS	1A,LB,2B,3A,4A,4B		
GENERATORS	1,2,3,5,6,7,8		
EVAPORATORS	4,5, FEED	1,2,3	FRESH
MAX SPD AVAILABLE	28.5 KNOTS		
1 AUX OUT OF	1MMR		
2 AUX OUT OF	4MMR		
EOOW	LT THRALLS		CENTRAL - 886

Figure B-11.

FUEL & WATER REPORT

CV-63 ENGINEERING REPORT
AS OF 11:43 13-May-78

CURRENT DATE 13-May-78 CURRENT TIME 14:40
FUEL & WATER REPORT

ITEM	REMARKS
FUEL % AS OF 0001	70.1%
FEED %	91.7%
FRESH %	83.5%
INJECTION TEMP.	68 DEGREES

DRAFT REPORT

MEAN DRAFT	34 FT 5.5 IN
FWD DRAFT	30 FT 9.0 IN
AFT DRAFT	36 FT 4.0 IN
DISPLACEMENT	73,746 TONS
MOMENT TO HEEL 1 DEG	12330 FT-TONS (MOVE 240K LBS 100 FT)
TONS PER INCH	

A

Figure B-12.

AUXILLARY EQUIPMENT

CV-63 ENGINEERING REPORT
AS OF 11:54 13-May-78

CURRENT DATE 13-May-78 CURRENT TIME 14:41
AUXILLARY EQUIPMENT

ITEM	REMARKS
1. A/C PLANTS	2,5,6,11
2. FIRE PUMPS	9,12,13 ELECTRIC 7,8,10 STEAM
3. LP AIR COMP.	#5 OTL / #4 STBY
4. CRYOGENICS	SECURED
5. STEERING	PORT/PORT
6. FYROS	FWD OTL / AFT IN STANDBY
7. 400 CYCLE GEN.	L 300 KW
8. EMERG D/G	1,2,3 SET FOR AUTOMATIC START
9. LIQUID OXYGEN	310 GAL
10. LIQUID NITROGEN	230 GAL
11. HP AIR COMPRESSOR	1&3
12. MISC	3,5 REEFER COMPRESSORS

Figure B-13.

FOOD SERVICE EQUIPMENT A

CV-63 SUPPLY DEPARTMENT
AS OF 17:04 12-May-78

CURRENT DATE 13-May-78 CURRENT TIME 14:45

FOOD SERVICE EQUIPMENT

ITEM	REMARKS
VEGETABLE CHOPPER	AWAITING PARTS ETR 6/78
FINAL RINSE INJEC SCUL	AWAITING PARTS ETR 6/78
COKE MACH STBD AFT	C02 LEAKS ETR 6/78
COFFEE POT FWD	CONTROL BOARD RELAY ETR 6/78
COKE MACH FWD	LEAKS IN MACH ETR 6/78
MILD CABINE FWD	NEEDS NEW COMPRESSOR ETR 6/78
ICE FLAKER MACH STBE A	NEEDS NEW SEALS ETR 6/78
REACH IN REEFER AFT VE	needs compressor relay etr 7/78
GRIDDLE 72" STBD AFT G	NEEDS 3 NEW THERMOSTATS ETR 6/78
OVER #5 BOTTOM AFT CAL	COMPLETE NEW WIRE ASSY ETR 6/78
POTATO PEELER AFT VEG	NEEDS NEW BELTS ETR 6/78
ICE FLAKER MACH PT INBLOW ON FREON ETR 5/78	

Figure B-14.

CASREPTS/NORS REQN SUMMARY

CV-63 SUPPLY DEPARTMENT
AS OF 17:07 12 May-78

CURRENT DATE 13-May-78 CURRENT TIME 14:47

CASREPTS/NORS REQN SUMMARY

ITEM	REMARKS	
OLD CASREPS	17	
NEW CASREPS	00	S-1
COMPLETED	02	
TOTAL CASREPS	15	
NORS	52	
NFE	72	
ANORS	02	
AWP	73	S-2
GSE	182	
TBOS/BROAD ARROW	00	
TBOS/DEG MAINT	00	

Figure B-15.

```
OUT OF COMMISSION
                    CV-63 AIR INTERMEDIATE MAINTENANCE
                        AS OF 14:56        12-May-78

    CURRENT DATE 13-May-78       CURRENT TIME 14:55
                         OUT OF COMMISSION #1

      ITEM                                 REMARKS

ASM-375 A7 ASN-90                  NORS/DEG MAINT 8101/8102/8129
NS-60 CRASH CRANE                  NORS/CASREP I/W 8131/XXXX/8160


 ! ! ! ! ! ! ! ! ! ! ! ! !CIA IS UP FOR TEST FLIGHT! ! ! ! ! ! !
```

Figure B-16.

```
CR01 - FACCON HF CIRCUITS, EXT 915, CONTA

                     CV-63 COMMUNICATIONS DEPARTMENT
                      AS OF 07:37     12-May-78

    CURRENT DATE 13-May-78                   CURRENT TIME 14:57
                 CR01 - FACCON HF CIRCUITS, EXT 915, CONT

    ITEM                      REMARKS

EQUIPMENT                  DATE           TROUBLE/REMARKS/ETR
SRR-19                  24 NOV 78         BAD RF POT
URA-17                  26 FEB 78         ATTENUATED SIGNAL TO DRAWI
URC-85                  14 APR 78         BAD AMP MOD
SRC-21                  29 APR 78         BLOWN FUSE IN COUPLER
SRC-20                  17 APR 78         NO PWR OUT
SRC-21                  29 APR 78         BLOWN FUSE IN RMT
URT-24                  03 MAY 78         LEAKY COUPLER
KW-7                    11 MAY 78         BAD OUTPUT
```

Figure B-17.

SWO PQS STATUS, PAGE 2A

CV-63 TRAINING DEPARTMENT
AS OF 11:08 10-May-78

CURRENT DATE 13-May-78 CURRENT TIME 15:00

SWO PQS STATUS, PAGE 2

ITEM		REMARKS		
CURTIS	OCT 79	4080	99	+660
ROWLAND	JUN 78	1638	40	-2472
TRUJILLO	NOV 79	3077	74	-163
KACZMARSKI	JAN 80	3104	75	+224
MCCARTHY	JAN 80	3248	79	+368
CORSI	MAR 80	2072	50	-448
RUESCH	MAR 80	2932	71	+412
UNDERSNADER	MAR 80	2552	63	+32
WELLS	MAR 80	2446	60	-74
AMABILE	MAY 80	2982	73	+822
AHWLEY	JUN 80	3517	85	+1537
NEWTON	JUN 80	2074	50	+274

SWO PQS STATUS, PAGE 3

Figure B-18.

CASREP SUMMARY
AS OF 19:01 17-Apr-78
CURRENT 15:05 13-May-78
MISSION AREA...MOBILITY-PAGE 1

NUMBER/RAT/EQUIPMENT	ETR/SITREP	DUE
77-045 FRESH WATER LP DRAIN TANK PUMP 3MMR	27 APR	27 APR
77-169 NR 11 FIRE PUMP	26 APR	26 APR
78-016 A/C PLANT NO. 12 175 TON	20 APR	20 APR
78-028 NR. 4 DECK EDGE ELEVATOR	23 APR	20 APR
79-032 NR 38 MAIN FEED BOOSTER PUMP	14 MAR	14 MAR
79-039 5500 LB UPEER STAGE BOMB ELEVATOR #2	16 MAY	16 MAY
78-040 NR 2C MAIN FEED PUMP	15 MAY	15 MAY
78-045 1B2 FORCED DRAFT BLOWER	21 APR	21 APR
78-051 WAGER SMOKE INDICATOR SYSTEM FOR 4A	01 JUN	27 APR
78-055 NUCLEONIC BOILER WATER LEVEL INDICA	01 JUN	27 APR
78-056 NUCLEONIC BOILER WATER LEVEL INDICA-	01 JUN	27 APR
78-059 AIR CONDITIONING PLANT NO. 8	12 MAY	12 MAY

MOBILITY- PAGE 1
MOBILITY- PAGE 2

Figure B-19.

APPENDIX C

NAVOCEANO, INFORMATION PROVIDED

This appendix contains documentation obtained during a visit to this command, the contents of which are as follows:

- Letter, Performance Assessment of Commercial Automatic Data Processing Equipment in an Ocean Platform Environment, including descriptions of:
  - (1) Hydrographic Data Acquisition System (HDAS) Enclosure (1)
  - (2) Oceanographic Data Acquisition System (ODAS) Enclosure (2)
  - (3) Boat Data Acquisition System (BDAS) Enclosure (3)
  - (4) Bathymetric Survey System (BASS) Enclosure (4)
  - (5) Miscellaneous Commercial Automatic Data Processing Equipment on NAVOCEANO Survey Platforms Enclosure (5)
- Commercial ADPE Diagrams/Layouts

0 1 1 —

U.S. NAVAL OCEANOGRAPHIC OFFICE
NSTL STATION
BAY ST. LOUIS, MISSISSIPPI 39522

IN REPLY REFER TO
Code 6400:jad
10550
Ser 1227
3 OCT 1978

A-814
8142
8143

From: Commander, Naval Oceanographic Office
To: Commander, Naval Ocean Systems Center

Subj: Performance Assessment of Commercial Automatic Data Processing Equipment in an Ocean Platform Environment

Ref: (a) NOSC letter JGK:cap; NOSC CC08; Ser 814/154 dated 28 August 1978

Encl: (1) Description of the Hydrographic Data Acquisition System (HDAS)
(2) Description of the Oceanographic Data Acquisition System (ODAS)
(3) Description of the Boat Data Acquisition System (BDAS)
(4) Description of the Bathymetric Survey System (BASS)
(5) Miscellaneous Commercial Automatic Data Processing Equipment on NAVOCEANO Survey Platforms

1. Reference (a) requested that NAVOCEANO provide NOSC with information regarding NAVOCEANO's experience with the use of commercial automatic data processing equipment in an ocean platform environment. Enclosures (1) through (5) are provided in response to that request.

2. HDAS and ODAS are approaching the end of an anticipated ten-year life. Although the state-of-the-art which existed at their inception dictated that maintenance would be a relatively complex task, both systems have proven themselves to be reasonably reliable. A specification is presently being developed to permit the replacement of both of these systems with a single system capable of meeting both the hydrographic and oceanographic needs of NAVOCEANO.

3. Of all the systems described in the enclosures only BDAS was less than satisfactory. The severity and wide range of environmental conditions aboard a survey launch eventually caused the failure of the system. BDAS was a contemporary of HDAS and ODAS.

4. BASS is quite likely the most sophisticated oceanographic survey tool in the world. NAVOCEANO's experience with the commercial automatic data processing equipment used in the system indicates that it is reliable and relatively easy to maintain.

5. NAVOCEANO has had great success with the use of commercial automatic data processing equipment aboard survey ships. One of the reasons for that success is the attention that is paid to providing a shipboard environment that conforms to the vendor's specifications. Because much

of the remainder of the survey electronics equipment requires the same high-quality power and climate control as the computer equipment, provision of the additional power and air-conditioning required by the commercial data processing equipment is usually a practical approach.

J. R. McDonnell

J.R. McDONNELL

HYDROGRAPHIC DATA ACQUISITION SYSTEM
(HDAS)

The Hydrographic Data Acquisition System (HDAS) is an automated shipboard system which permits real-time collection and post-time processing of hydrographic survey data. Sensors interfaced to the system include long range and short range navigation receivers, a satellite navigation receiver, a variety of sonar systems, gyrocompass, electromagnetic log, gravity meter and magnetometer.

In addition to the collection of data and its storage on magnetic tape, HDAS displays ship's track on a flatbed plotter in near real-time. HDAS has been installed on USNS KELLAR, USNS KEATHLEY, USNS WYMAN, USNS CHAUVENET and USNS HARKNESS. It is presently installed on only USNS CHAUVENET and USNS HARKNESS.

The following is a list of the commercial automatic data processing equipment which has been used in HDAS, its manufacturer and quantity per system.

Item	Model	Manufacturer	Quantity
Computer	PDP-9	Digital Equipment Corp.	2
Typewriter	KSR-35	Teletype	2
Typewriter	LA-36	Digital Equipment Corp.	2
Flatbed Plotter	502	Calcomp	2
Drum Plotter	564	Calcomp	2
Tape Unit	1427H556	Digi-Data	3
Drum Memory	RM09-C	Digital Equipment Corp.	1
A-D Converter	AF01-B	Digital Equipment Corp.	1

Enclosure (1)

OCEANOGRAPHIC DATA ACQUISITION SYSTEM
(ODAS)

The Oceanographic Data Acquisition System (ODAS) consists of sensors, computer hardware and computer software. Certain sensors are interfaced to the computers for real time processing and others are interfaced to off-line recording devices. Two identical DEC PDP-9 computers are inter-faced by means of a four way switch to (1) the sensors and (2) the processing peripherals. This permits either computer to be used for real time data acquisition or post-time processing. Thus, data collection and post-time processing can occur at the same time. The acquisition computer is available to back up the processing computer and vice versa. Each computer has sixteen thousand word memory. Also, each computer has 262 thousand words of disk storage, two seven track tape drives, a paper tape reader/punch, and a teletype console. The computers share four DEC tape transports, a card reader, a line printer, two 30 inch drum plotters, and a flatbed plotter.

The present real time acquisition parameters are sea surface temperature, bathymetry, magnetics, and time. Other data such as navigation and the on-station parameters are collected off-line and input to the post processing phase of ODAS.

ODAS is installed on USNS KANE, USNS BENT, and USNS WILKES.

Commercial automatic data processing equipment used in ODAS includes:

Item	Model	Manufacturer	Quantity
Computer	PDP-9	Digital Equipment Corp.	2
Tape Units	TU-10	Digital Equipment Corp.	4
Tape Units	TU-56	Digital Equipment Corp.	4
Disc Drives	RS-09	Digital Equipment Corp.	2
Typewriter	LA-36	Digital Equipment Corp.	1
Typewriter	LA-30	Digital Equipment Corp.	3
Drum Plotter	563	Calcomp	2
Drum Plotter	565	Calcomp	2
Flatbed Plotter	502	Calcomp	1
Card Reader	M200	Documation	2
Line Printer	1021	Data Products	1
A-D Converter	AF01B	Digital Equipment Corp.	1

Enclosure (2)

BOAT DATA ACQUISITION SYSTEM

The Boat Data Acquisition System (BDAS) is a smaller version of HDAS and was designed to be suitable for installation on 36-foot soundboats. The system was capable of being interfaced to several short range navigation receivers, a gyrocompass and a shallow water echo sounder.

BDAS was installed aboard soundboats carried by USNS KELLAR, USNS CHAUVENET and USNS HARKNESS. It has been removed from all soundboats.

Commercial automatic data processing equipment used with BDAS included the following:

Item	Model	Manufacturer	Quantity
Computer	PDP-8/L	Digital Equipment Corp.	1
Tape Unit	1427H556	Digi-Data	1
Drum Plotter	564	Calcomp	1

Enclosure (3)

BATHYMETRIC SURVEY SYSTEM
(BASS)

The Bathymetric Survey System (BASS) is an automated shipboard system for the collection of precise bathymetric data. BASS/BOTOSS is made up of two major subsystems - the sonar subsystem and the navigation subsystem.

The sonar subsystem is controlled by two computers operating in a master/slave arrangement. The master computer has access to a variety of peripherals including magnetic tape drives, a CRT terminal, a line printer, and a high-speed special purpose data processor.

The navigation subsystem master computer is interfaced to the sonar subsystem master computer and to two other computers - one for inertial navigation and one for satellite navigation. Peripherals associated with the navigation subsystem include magnetic tape drives, typewriters, a drum plotter, and a flatbed plotter. Mass storage is provided by a disc.

In addition to the peripherals listed, both subsystems are interfaced to various sensors to provide a complete bathymetric survey system. BASS/BOTOSS is installed on USNS WYMAN.

The following commercial automatic data processing equipment is used in BASS:

Item	Model	Manufacturer	Quantity
Computer	HP2100	Hewlett-Packard	5
Computer	SP900	Sperry	1
Disc Drives	HP7900A	Hewlett-Packard	2
Tape Units	HP7970B	Hewlett-Packard	4
Drum Plotter	936	Calcomp	1
Flatbed Plotter	502	Calcomp	1
Typewriter	Termi Net 300	General Electric	4
Line Printer	HP2767A	Hewlett Packard	1
CRT Terminal	4010	Tektronix	1

Enclosure (4)

MISCELLANEOUS COMMERCIAL AUTOMATIC DATA
PROCESSING EQUIPMENT ON NAVOCEANO
SURVEY PLATFORMS

In addition to the major collection and processing systems, NAVOCEANO uses commercial ADP equipment as an intergral part of a number of smaller systems. Some of these systems, the equipment used and the type of application to which it is used is as follows:

Bell Aerospace BGM-2 Gravity Meter

A Digital Equipment Corporation PDP-8/E computer, Teletype ASR-33 typewriter and Digi-Data 1427H556 tape unit are used for gravity data collection and preprocessing.

La Coste and Ramberg Gravity Meter

A Data General Nova 800 computer, Digital Equipment Corp. LA-36 typewriter, and Digi-Data 1427H556 tape unit are used for gravity data collection and preprocessing.

Wang 2200 Computer

Used for geodetic computations and digitizing recorder traces the system, consists of a Wang 2200 computer, Wang 2217 cassette drive, Wang 2262 digitizer, Wang 702 output writer and Wang 2212 X-Y plotter.

HYSURCH

HYSURCH is a boat data acquisition system and van-installed data processing system. Commercial automatic data processing equipment used in the boat is a Control Data Corporation 5100 Computer and a Kennedy 1400 Recorder.

Van equipment includes a Honeywell 516 computer, Digital Development Corp. 14210 Disc, Teletype ASR-35 typewriter, three Kennedy 3112 tape drives and a Calcomp 763 drum plotter.

Integrated Command ASW Prediction System (ICAPS)

ICAPS uses commercial automatic data processing equipment to execute software models used to develop predictions of local ocean acoustic properties. The hardware is currently installed aboard USS AMERICA and USS SARATOGA.

The computer used in ICAPS is the Data General Nova 800/820. Other commercial equipment in the system includes the Pertec Inc. Series 6000 tape drive, Caelus 303 disc drive, Zebec ZEF-50 floppy disc, Dicom 344 cassette unit, and Tektronix 4002A display terminal.

Enclosure (5)

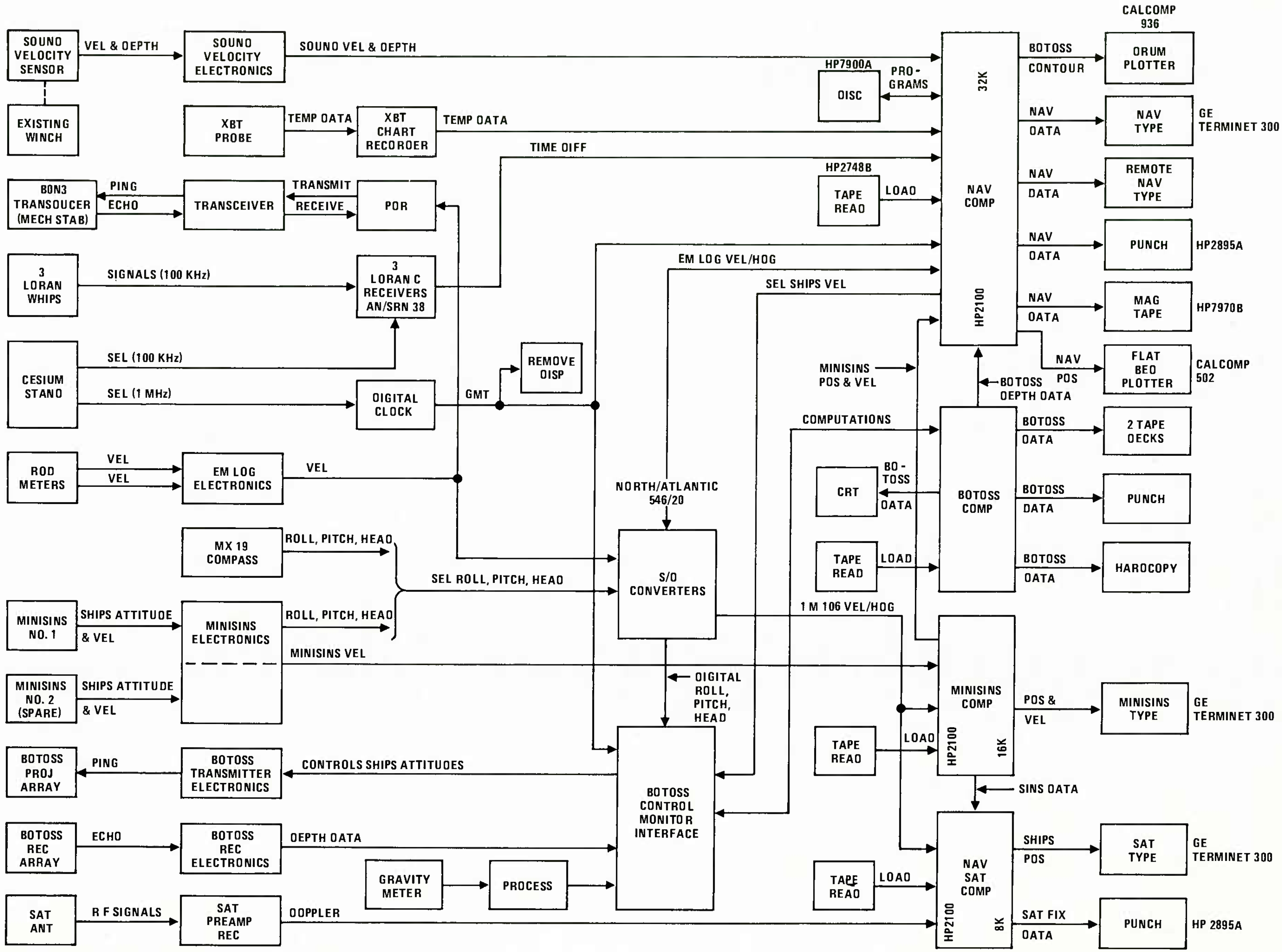

Figure C-1. BASS system diagram.

BOTOSS/NAVIGATION SUBSYSTEM INTERFACES:

- A - ACO SWITCHBOARD (BASS UNIT 2)
- B - BASS 400 Hz POWER AND PRECISION 60 Hz SWITCHBOARD (BASS UNIT 1)
- C - NAVIGATION/BOTOSS INTERFACE CABINET (BASS UNIT 60)
- D - NAVIGATION COMPUTER/COMPUTER-TO-COMPUTER INTERFACE (BASS UNIT 16)
- E - GREENWICH MEAN TIME CLOCK (BASS UNIT 14)

BOTOSS EQUIPMENT:

- 1 - BOTOSS UNIT 1 RCVR, PREAMPLIFIER CABINET
- 2 - BOTOSS UNIT 2 RCVR, HIGH SPEED SIGNAL PROCESSOR CABINET
- 3 - BOTOSS UNIT 3 XMTR, BEAM STEERING AND SIGNAL CONDITIONER CABINET
- 4 - BOOTSS UNIT 4 XMTR, POWER AMPLIFIER CABINET
- 5 - BOTOSS UNIT 5 CMPTR, COMPUTER CABINET (HP2100 SLAVE)
- 6 - BOTOSS UNIT 6 CMPTR, COMPUTER AND INTERFACE CABINET (HP2100 MASTER)
- 7 - BOTOSS UNIT 7 CMI, OPERATOR CONSOLE CABINET
- 8 - BOTOSS UNIT 8 POU, POWER DISTRIBUTION CABINET
- 9 - BOTOSS UNIT 9 LINE PRINTER
- 12 - BOTOSS UNIT 12 WATER LEVEL MONITOR

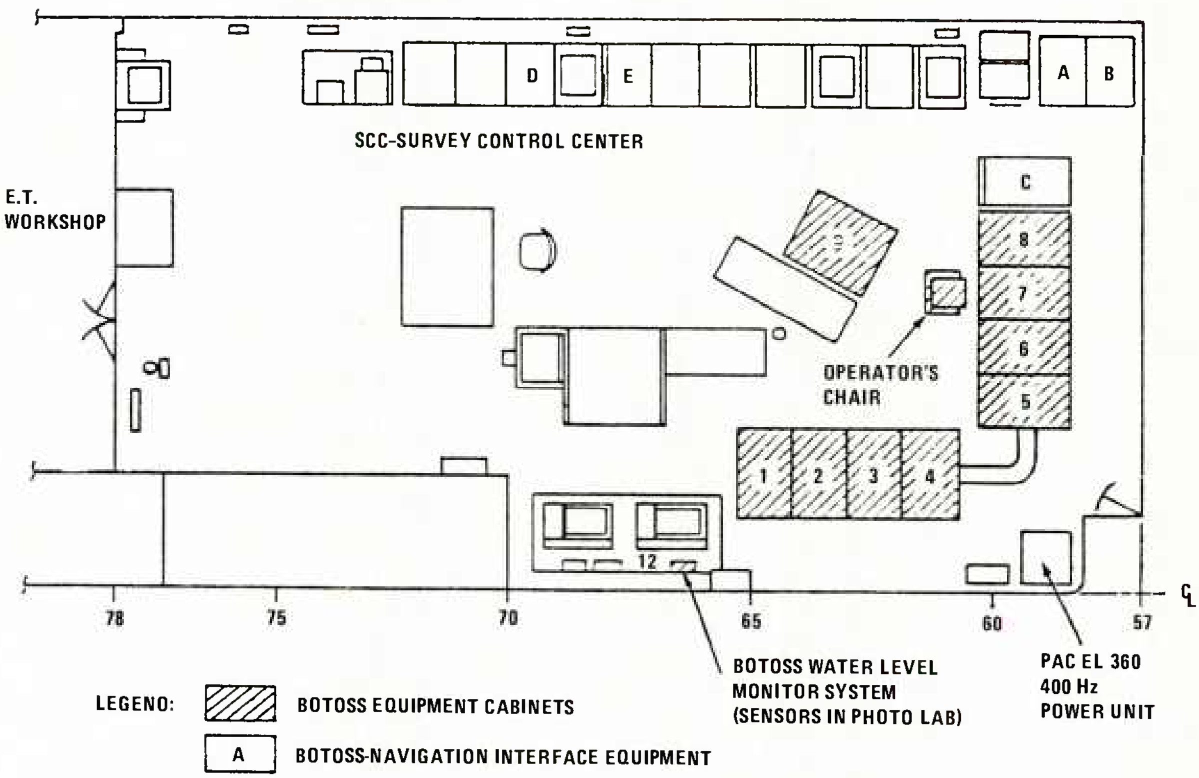

Figure C-2. Location of BOTOSS subsystem equipment.

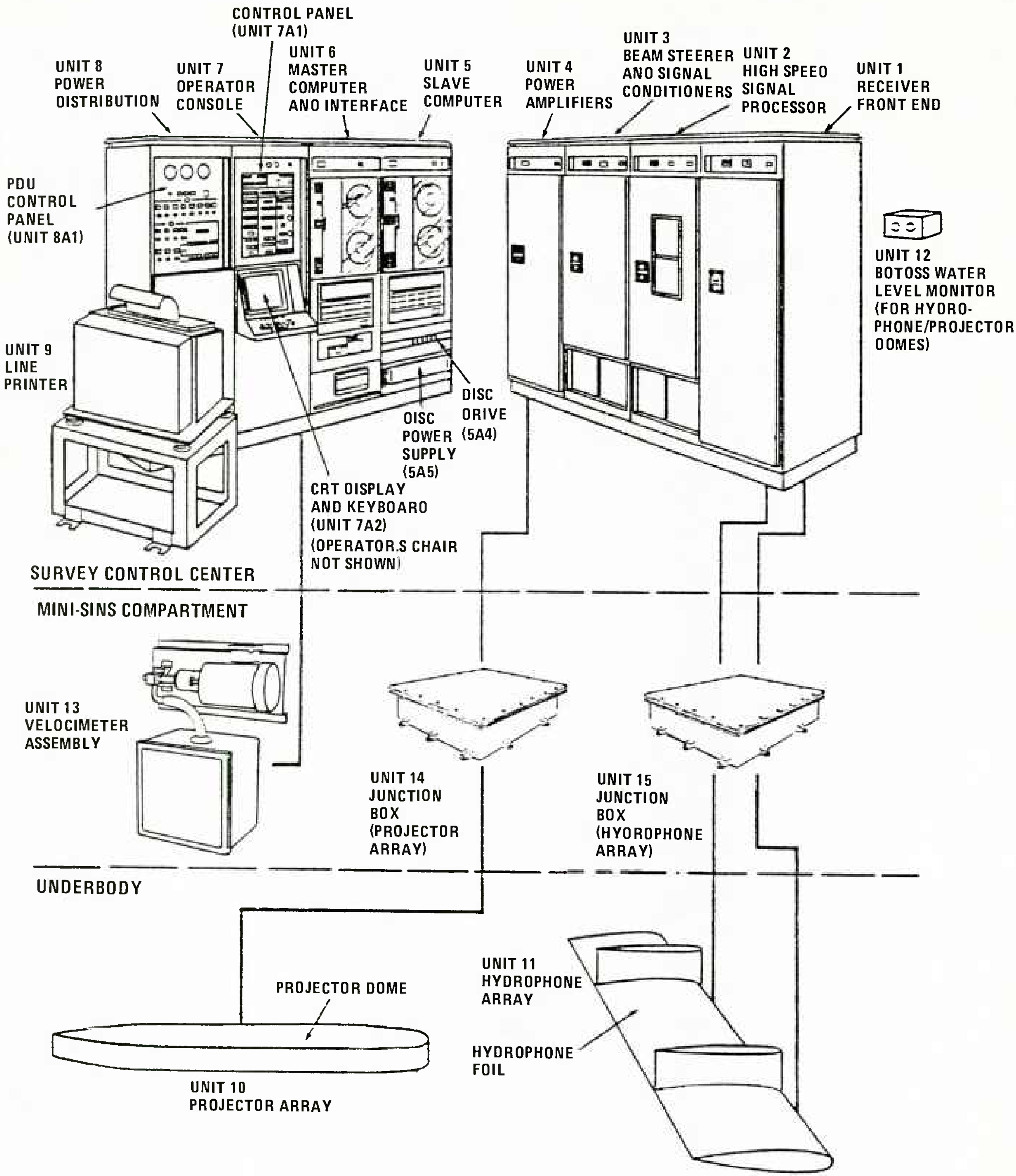

Figure C-3. BOTOSS subsystem - equipment relationship.

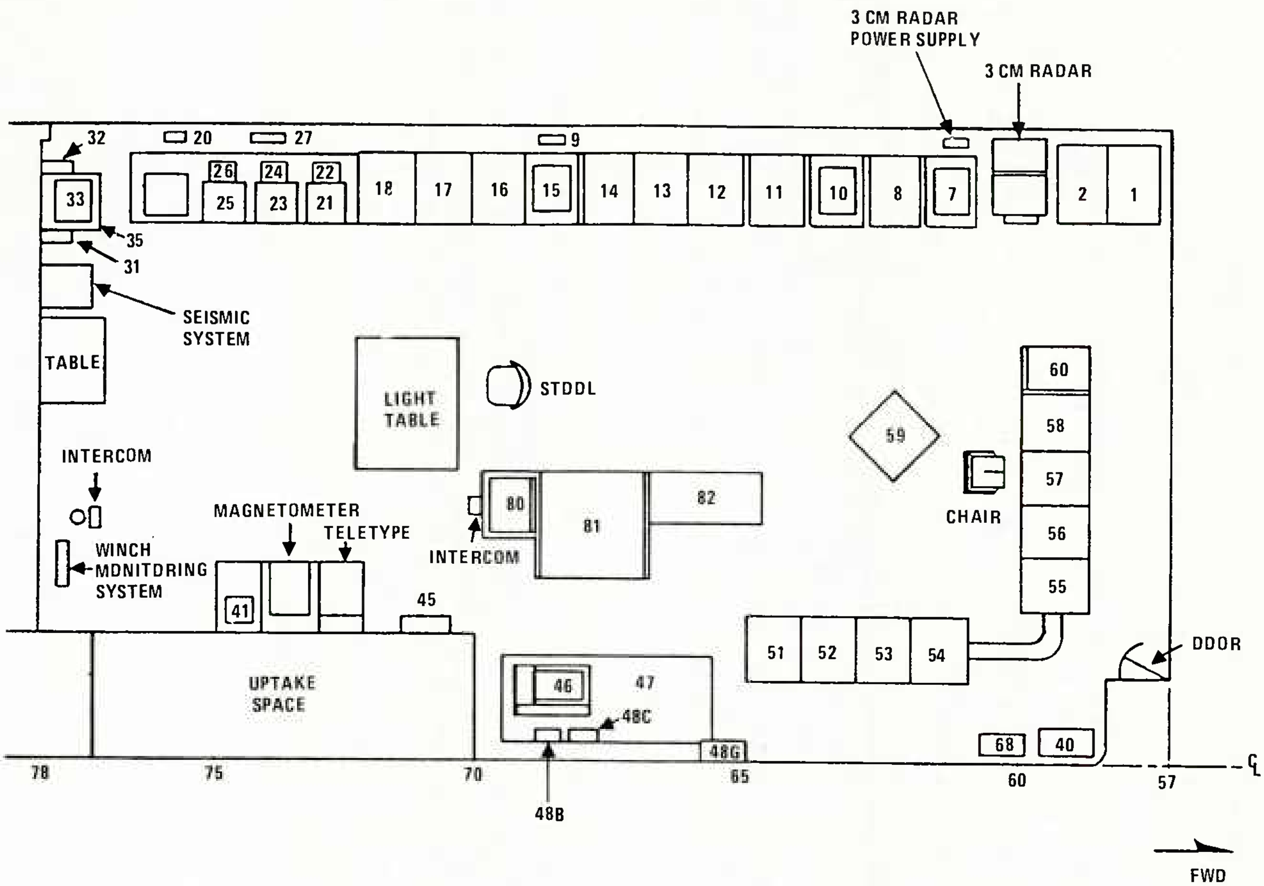

Figure C-4. Navigation Information Center (NIC), equipment layout.

Table C-1.

UNIT NO.	EQUIPMENT	UNIT NO.	EQUIPMENT
1	BASS 400 Hz POWER AND PRECISION 60 Hz SWITCHBOARD	40	EO Hz PRECISION FREQUENCY UNIT
2	ACO SWITCHBOARD	41	XBT CHART RECORDER
7	SATELLITE INPUT/OUTPUT PRINTER	45	NIC REMOTE GMT DISPLAY
8	SATELLITE RECEIVER SYSTEM CABINET	46	PRECISION DEPTH RECORDER
9	MINISINS ALARM JUNCTION BOX	47	SECONDARY SONAR EQUIPMENT CABINET
10	MINISINS INPUT/OUTPUT PRINTER	48B	SELECTED HEADING INDICATOR
11	MINISINS NAVIGATION CONTROL CONSOLE (NCC)	48C	MK19 HEADING INDICATOR
12	MINISINS COMPUTER SYSTEM CABINET	48G	REMOTE STABILIZER CONTROL PANEL
13	SOUND VELOCITY SYSTEM CABINET	51	BOTOSS UNIT UNI RCVR, PREAMPLIFIER CABINET
14	TIME SYSTEM CABINET	52	BOTOSS UNIT UN2 RCVR, HIGH SPEED SIGNAL PROCESSOR CABINET
15	NAVIGATION LOCAL INPUT/OUTPUT PRINTER	53	BOTOSS UNIT UN3 XMTR, BEAM STEERING AND SIGNAL CONDITIONER CABINET
16	NAVIGATION COMPUTER SYSTEM CABINET C	54	BOTOSS UNIT UN4 SMTR, POWER AMPLIFIER CABINET
17	NAVIGATION COMPUTER SYSTEM CABINET B	55	BOTOSS UNIT UN5 CMPTR, COMPUTER CABINET
18	NAVIGATION COMPUTER SYSTEM CABINET A	56	BOTOSS UNIT UN6 CMPTR, COMPUTER AND INTERFACE CABINET WC
20	MIC 400 Hz RECEPTACLE	57	BOTOSS UNIT UN7 CMI, OPERATOR CONSOLE CABINET
21	LORAN-C RECEIVER (SPARE)	58	BOTOSS UNIT UN8 PDU, POWER DISTRIBUTION CABINET
22	LORAN-C RANGE-RANGE/HYPERBOLIC MODE SELECTOR (SPARE)	59	BOTOSS UNIT UN9, LINE PRINTER
23	LORAN-C RECEIVER NO. 1	60	NAVIGATION/BOTOSS INTERFACE CABINET
24	LORAN-C RANGE-RANGE/HYPERBOLIC MODE SELECTOR NO. 1	68	60 Hz POWER PANEL
25	LORAN-C RECEIVER NO. 2	80	NAVIGATION REMOTE INPUT/OUTPUT PRINTER
26	LORAN-C RANGE-RANGE/HYPERBOLIC MODE SELECTOR NO. 2	81	FLAT BED PLOTTER
27	LORAN-C ANTENNA PATCH PANEL	82	DRUM PLOTTER
31	EM LOG INDICATOR-TRANSMITTER NO. 1		
32	EM LOG INDICATOR-TRANSMITTER NO. 2		
33	EM LOG-LORAN POWER PANEL		
35	BASS SYNCHRO SIGNAL AMPLIFIER		

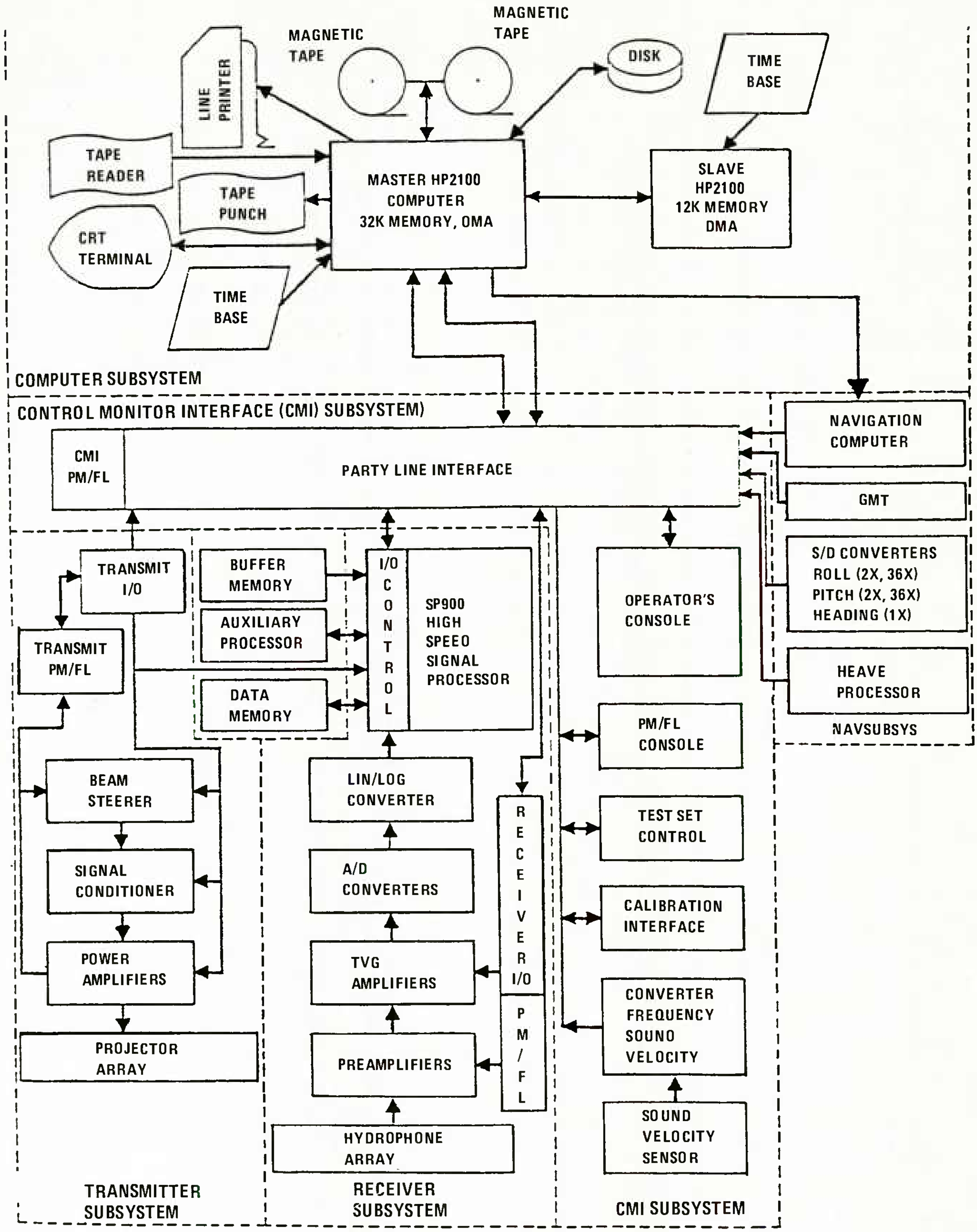

Figure C-5. BOTOSS block diagram.

APPENDIX D

COMNAVSURFPAC INFORMATION

The following documentation was provided by COMNAVSURFPAC as a result of an interview with a representative of that command. It consists primarily of an Automated Data System (ADS) plan for a shipboard logistic management system. It also contains some cost-savings figures in applying commercial ADP equipment aboard ship.

COMMANDER NAVAL SURFACE FORCE
UNITED STATES PACIFIC FLEET
SAN DIEGO, CALIFORNIA 92155

FF4-5
5231/WPC 1058
Ser N73-

From: Commander Naval Surface Force, U. S. Pacific Fleet
To: Commander in Chief U. S. Pacific Fleet

Subj: Shipboard Logistics Management System Proposal

Ref: (a) OPNAVINST 5231.2
(b) CINCPACFLTINST 5231.2
(c) CINCPACFLTINST 5236.1

Encl: (1) Automated Data System (ADS) Plan for Shipboard Logistic Management System

1. The Navy's Shipboard Non-Tactical ADP Program (SNAP-II) was initiated in recognition of a need to alleviate manual processing of an increasing number of files, records and reports maintained by the smaller fleet units of the Surface Force. However, the SNAP-II Program has encountered repeated delays for numerous reasons, e.g., lack of documented verifiable benefits, inadequate installation cost projections, personnel and training requirements, etc. The time associated with SNAP-II ADS plan revisions to correct deficiencies, hardware procurement, and design, writing and testing of computer programs will cause further delays in realizing the benefits of this vital program.

2. While the SNAP-II Program confronts numerous deleterious obstacles, non-mechanized units of the Force continue to be burdened with processing a large volume of information and records requiring labor-intensive, repetitive manual actions. This reduces efficiency and results in unnecessary delays in the flow of material and maintenance support, thus reducing operational readiness. In order to alleviate the impact of the foregoing delays, it is strongly recommended that a short-term limited project to evaluate, enhance and convert existing COMNAVSURFPAC staff software to a SNAP-II compatible format be undertaken. The primary objective of the proposed project is to reduce the volume of manual processing by non-mechanized units of the Force; and to have in-hand a proven software package when SNAP-II hardware becomes available.

3. The proposed project can be accomplished by taking advantage of COMNAVSURFPAC investment in software development incurred during a 1976 project to demonstrate utility of using microprocessors on afloat units (NAVMACPAC Report 170-76 of NOV 76). With modest efforts the products which were developed during this test can be modified to operate on various mini-computers. The developed software description and functions are as outlined in Appendix III to enclosure (1).

4. The short-run benefits of the proposed logistics management system to NAVSURFPAC selected units are as follows:

a. Significant reduction in direct labor associated with supply and maintenance management.

b. Increased operational readiness through shortened requisition preparation/processing time, thus reducing the time required to obtain material.

c. Increased control of funds and materials.

d. Improved ships maintenance management by providing the units with a more timely, accurate and usable CSMP.

e. Improve efficiency of supply and maintenance supervisory personnel.

In addition, the long range benefits to the fleet in support of SNAP-II implementation are:

a. A more rapid introduction of automation by advancing the availability of field-tested application programs.

b. Documented training requirements to operate and maintain a mini-computer installation in an afloat environment.

c. Provide a basis for expansion for use in automating other functions.

5. Enclosure (1) has been developed in accordance with references (a), (b) and (c) and details the resource requirement and methodology to achieve the aforementioned benefits.

6. In order to achieve the benefits described above and in those outlined by (1), it is recommended that the resources in Appendix I to enclosure (1) be provided to implement the proposed project. The annual cost for personnel, hardware and miscellaneous expenses to support the above project is $155,000. It is further recommended that the system described in Appendix III of enclosure (1) be leased, with an option to buy, in order to utilize existing application programs and to provide an effective means of upgrading to a more cost-effective and transportable system.

7. Enclosure (1) is hereby forwarded requesting approval of the project commencing in FY 1979.

ADS PLAN FOR
SHIP'S LOGISTICS INFORMATION MANAGEMENT SYSTEM (SLIMS)

Reference: (a) OPNAVINST 5231.1
(b) CINCPACFLTINST 5231.2
(c) NAVSEA 04K SP-2 Automated Data System (ADS) Development Plan for Shipboard Non-Tactical ADP Program II of 30 Sept 1977
(d) COMNAVSURFPAC ltr FF4-3/73A:ss 5230 Ser N7-0540 of 25 Jan 1978

Appendix: I. Required Resources
II. Benefit Computations
III. System Descriptions
IV. Lease vs. Purchase Option Analysis

1. This ADS plan has been developed in accordance with references (a) and (b).

2. SLIMS is a NAVSURFPAC prototype project to refine existing and develop new non-tactical computer programs for use by SNAP-II hardware, when procured. Since the project is intended to support SNAP-II objectives, the generic economic justification provided for SNAP-II in reference (c) is considered applicable and is not restated. A preliminary version of the proposed SLIMS project, intended to test the feasibility of, and the economic benefits to be gained from, the use of mini-computers afloat, was operationally tested at sea by NAVSURFPAC during the period February-August 1976. This test results reported in reference (d), were highly successful and indicated that significant benefits could be gained from a mechanization program for smaller ships. For the SNAP-II hardware, when procured, to realize the benefits, however, computer application programs to provide the necessary capabilities are required. A number of application programs were developed for the at-sea testing reported reference (d). The SLIMS project is intended to:

(1) Shorten the time-span between approval of SNAP-II hardware procurement and the availability of a viable system (i.e., hardware plus computer application programs) afloat.

(2) To take advantage of effort already expended in computer program development by studing adequacy of the existing programs, enhancing them as necessary to provide additional desirable capabilities, and converting these to standard programming language which will be acceptable to SNAP-II hardware, when available.

b. The SLIMS project will:

(1) Install one suite of mini-computer equipment on a selected CG (USS ENGLAND (CG-22)).

(2) Operate and collect data on the adequacy of existing computer programs to meet defined objectives.

(3) Determine, from afloat users, desired enhancements required for existing computer programs.

(4) Upgrade existing COMNAVSURFPAC mini-computer suite to provide a capability to convert the existing programs to a standardized programming language.

(5) Enhance and convert the computer programs.

(6) Provide the new programs to the project ship for testing and operational use.

(7) Make resulting programs available for interfacing with the SNAP II hardware, when procured.

In addition to the economic benefits to be gained by amortization of costs already expended for existing software and by earlier access to SNAP II benefits as hardware is delivered and installed, the SLIMS project will also derive tangible economic benefits (see Appendix II) as well as acquiring some ADP expertise in advance of SNAP II delivery.

c. Synopsis

(1) Application Name. Ship's Logistic Information Management System (SLIMS).

(2) Overview. Manual processing of an increasing number of records on non-mechanized fleet units has decreased supply and maintenance management efficiency. Reduced efficiency results in a slower flow of materials and services to NAVSURFPAC units, and thus, has a significant impact on operational readiness. OP-942 has initiated the SNAP II Program to procure mini-computer systems for ships. The ADS (Automated Data System) development plan states that hardware delivery will start one year after plan approval. Design and testing of computer programs will probably further delay shipboard implementation until approximately 1981. The problem, then, is providing a reasonable measure of relief for ships' logistics and maintenance management information processing problems until a formal solution can be implemented. Early implementation of SLIMS as a prototype for SNAP II will provide the following advantages:

(a) Reduce direct labor associated with the administration of the critical functions of supply and maintenance management. Software programs automating subsystems of financial management and requisition accounting, and Current Ship Maintenance Project (CSMP) have already been operationally tested at sea. Additionally there are a large number of other programs available from Navy users in the following areas - data base management, word processing and administrative control.

(b) Improved specifications, definitions and dimensions of ships' ADP information requirements.

(c) Rapid use of SNAP II hardware, by advancing the delivery of field-tested application software programs.

(3) Location. The afloat system will be initially installed in a vacated fire control equipment space aboard the USS ENGLAND (CG 22). The other system will be used to upgrade hardware suit at CNSP Headquarters for software modification, enhancement, test and debugging.

(4) Point of Contact. The Staff ADP Technical Advisor, Mr. Paul Sutton, (714) 437-2711 (AV: 958-9711).

(5) Purpose. The shipboard system will be used for:

(a) Implementing the Shipboard Automated Storekeeper Subsystem (SASS). This subsystem automates the following tasks:

1. Posting supply requisitions to the OPTAR log (maintained on a disk cartridge).

2. Updating requisition status.

3. Posting receipt documents.

4. Following up requisitions with overdue delivery dates.

5. Preparation of departmental budget reports.

6. Preparation of requisition (DD 1348M) in machine readable format which can be directly entered into ashore supply computers.

(b) Implementing the Shipboard Automated CSMP (Current Ship's Maintenance Project) Subsystem (SACS). This subsystem automates the following tasks:

1. Data storage. Maintenance data from the OPNAV 4790.2K is key-entered direct to disk by means of a data entry program permits block mode data entry via the OPNAV 4790.2K/Q or R formats, and on-line editing. In this manner, maintenance data can be added, corrected, modified, and deleted.

2. Information retrieval. Maintenance information from the ship's CSMP disk file can be retrieved in three different formats:

a. Mini-CSMP report (Report 1, option B).

b. On preprinted OPNAV 4790.2Q or R forms.

c. On-line retrieval of the data.

Information retrieved can include the entire CSMP file or only those records (jobs) which meet criteria specified by the user. The user can specify up to ten search arguments for each of any four fields (blocks on OPNAV 4790/2K). Search logic can include matched values (field value and search argument), fields with values within a range of two (low and high) search argument values, and fields with values that do not match search argument values.

(c) Automating additional ship logistics functions by using the following data base management systems:

1. DBMS (Data Base Management System). This system is actually a comprehensive single-file, data management and report generation system. It is a self-prompting, user-oriented system which permits non-programmers, with only minimal training, to define and update information files in any desired sequence. Additionally, the user can retrieve only that information which corresponds to user-specified search logic (boolean linked data field arguments). The DBMS system automatically produces application system documentation as a by-product of on-line system creation, and makes system modification an easy on-line procedure.

2. ADAMS (Automatic Data Management System). This system is a "true" data base management system which facilitates on-line construction of information files. The system provides for independence of applications programs and data bases. ADAMS also includes powerful, sophisticated on-line inquiry and report generation modules.

(d) Automating administrative control tasks by providing a word processing capability. Several word processing systems, e.g., "LABELS," "FORMATTED REPORTS," "TEXT EDITOR," "GENERALIZED DESIGN AND FORMAT PROGRAM," "NISC WORD PROCESSOR," are available which provide document creation, text editing, formatting, retrival and document reproduction. Additionally, there are two administrative control systems available to maintain correspondence/message/directive control records and facilitate on-line inquiries to administrative data bases, CATS (COMNAVSURFPAC Automated Tickler System), and CORDEX-E (built by COMNAV-AIRPAC).

(6) Benefits

(a) The Shipboard Automated Storekeeper Subsystems (SASS) provides the following benefits:

1. Reduces the time to post, update and check requisition statu.

2. Reduces the time to prepare a departmental budget.

3. Eliminates manual typing of requisitions (DD1348) -- the data is keyed in only once when it is posted.

4. Reduces the time to post receipt documents.

5. Eliminates ashore supply center key entry and verification of requisitions and thus response time.

6. Eliminates manual assignment of requisition serial numbers and OPTAR balance decrementing.

7. Facilitates routine follow-up of all overdue requisitions and closer monitoring of material status and budget.

8. Reduces delivery time of parts and materials to the ship by eliminating processing steps and excessive handling in the requisition cycle. Shortened delivery times of parts and materials needed for maintenance will result in direct gains in operational readiness.

9. As shown in appendix II, SASS will result in a combined direct/potential savings of at least 944 manhours ($5,938) per ship per year, for a class 16/26 CG (see Appendix II for benefit calculations).

(b) The Shipboard Automated CSMP Subsystem (SACS) provides the following benefits:

1. Reduces the time to document a completed maintenance action aboard ship.

2. Eliminates manual data entry at DPSCPAC or the IMA.

3. Eliminates OPNAV 4790.2K forms and mailing costs (external to the ship).

4. Eliminates NAVSURFPAC handling and mailing of monthly CSMPs and AWR packages.

5. Reduction of data entry errors via on-line editing.

6. Improvement in the timeliness of CSMP data from 3 to 4 four weeks out of date to near real time.

7. Improvement in maintenance management and control through on-line, selective retrieval of more accurate CSMP information.

8. As shown in enclosure (2), SACS will result in a combined direct/potential cost savings of at least 179 manhours ($1387) per ship per year for a class 16/26 CG (see Appendix II for benefit calculations).

(c) The data base management systems, DBMS and ADAMS, will facilitate automatic on-line construction and maintenance of information files and reports. These systems will make it possible to design new applications with a minimum investment of time and effort. Most important, they provide considerable independence between application programs and information files. These systems automatically produce systems documentation as a natural by-product of creating an applications system. Finally, both systems include powerful, general purpose query languages which can be used by the end-user to respond to unanticipated information requests without having to write special programs to extract the data. The combined effect of these features will be development of new applications in a fraction of the time previously required, and easier system maintenance.

(d) Word processing and automated administrative control systems will provide the following benefits:

1. Increased accountability and control of correspondence, messages, directives, and documents.

2. Fewer manhours to prepare, disseminate, store and retrieve correspondence, messages, directives and documents.

3. Fewer errors in filing, and in the material itself.

4. Increased responsiveness to external, unanticipated requests for information.

(7) Funding. No funds are presently available or programmed for this project. As shown in Appendix II, required funds are within the CINCPACFLT threshold level for ADS development through prototype installation.

(8) Program Maintenance and Development. SLIMS will require modest maintenance before it can be used in a new environment. The data base management systems, however, can be used immediately --without modification. Successful maintenance of existing programs and an orderly development of new applications will require contract programmer services or the acquisition of additional in-house personnel. Due to the dynamic nature of developing applications aboard ship, some in-house, civilian or military personnel will be needed, because much of the development work is of a "personal services nature" (e.g., continuous revision of program specifications as applications evolve from end-user feedback; unpredictable demands for debugging services). Appendix I defines required personnel resources.

(9) Alternatives. For the reasons stated in reference (c), a small, commercial computer system is considered preferable to other generic alternatives, e.g., shore-provided batch services. The existing software can run, without change, in a shipboard environment, with the equipment listed in Tab A to enclosure (1) of reference (d). Procurement of any type of hardware, other than that for which the existing programs were written would introduce additional costs for conversion and testing and would, more importantly, delay project start until a full suite of the new hardware were procured for CNSP and the programs were adapted to run on that equipment. Since the primary purpose of SLIMS is to advance the date that operating software would be available to the fleet, such an approach was considered counterproductive.

d. Discussion

(1) The required equipment is shown in Appendix III. It will be noted that the proposed shipboard and shore support systems are different. One system is initially required aboard ship to facilitate immediate implementation of existing application programs In order to provide program maintenance of these ship applications, a 32K work station, printer, and a disk multiplexer must be added to NAVSURFPAC'S existing system. Without these additions, system loading would inhibit timely program maintenance.

(2) Ultimately, a microprocessor is not the best choice for shipboard applications. For approximately the same cost, any number of considerably more powerful mini-computer can be obtained, which would provide a multi-programming, multi-job environment and includes ANS74 COBOL and RPGII capability. Accordingly, the mini-computer will be used by NAVSURFPAC for conversion of existing application programs and development of new shipboard applications. When conversion is completed, the microprocessor will be phased out, and replaced by the mini-computer.

Existing BASIC programs require about 20% recoding to make them compatible with the mini-computer system. Before the mini-computer system is installed aboard ship, NAVSURFPAC'S current mini-computer system can be used to develop additional ship applications in ANSCOBOL, which can be complemented by any number of very powerful, general purpose data base management systems.

(3) The initial version of SLIMS utilized a microprocessor - controlled card reader/punch for interfacing with card-bound supply centers. Initially, the card reader/punch will be used on the ship and at NAVSURFPAC for system operation and program maintenance. As the project progress, input and ouput programs will be modified to utilize 5-level paper tape to permit the ship to both send and receive data through the existing shipboard communications system. Similarly, magnetic tape will be introduced for data base transfers between ship and shore facility, and for processing larger data files. Both systems will, therefore, initially require a card/reader punch and a paper tape reader/ punch. Eventually the card handling equipment will be phased out as communications tape is phased in.

(4) During FY80, applications programs developed for the microprocessor system will have been converted to run on the more powerful mini-computer system (using available on-line edit program), and additional applications programs will be available. These additional programs can be developed in ANS74 COBOL, and will exploit productivity enhancing features of the data base management system. Accordingly, the microprocessor system will be replaced by a mini-computer system during FY80. Early delivery of the shore based mini-computer system will facilitate early development of additional applications and provide a system for parallel operations and debugging - during the conversion.

(5) Appendix IV indicates that it would be less expensive to purchase the systems described in Appendix III. If OPN funds are readily available, then purchasing would be recommended if cost was the only criteria. This is not the case however, since there are several risk factors involved (see Appendix IV). Since OM&N dollars are more likely to be available or reprogrammable, and early implementation is important in order to dovetail the results of this project with SNAP II efforts, leasing (with an option to buy) may be a more suitable choice.

Table D-1. Required Resources

	Hourly Rate	Monthly	FY79	FY80
Equipment:				
rent			$ 55,464	$ 59,660
maintenance			13,850	15,676
interfacing			2,000	2,000
maintenance training			4,000	-
Sub-Total			$ 75,314	$ 77,336
Contract Programmers				
Senior Application Programmer	$16.60	$2,877.33	$ 34,528	$ 34,528
Senior Application Programmer	16.60	2,877.33	34,528	34,528
Sub-Total			$ 69,056	$ 69,056
Consumables: disk packs, paper, etc.			$ 7,000	$ 7,000
Travel			4,000	2,000
TOTAL			$155,370	$155,392

BENEFIT COMPUTATIONS

Shipboard Automated CSMP System:

Documentation of completion of deferred maintenance aboard ship:

manual time to document a completed action	10.0 min
time to enter deferred action item into system	(3.05 min)
time to enter completion data into system	(1.70 min)
time saved per completion	5.25 min

$$\frac{5.25\text{ min}}{\text{completion}} \times \frac{1\text{ mh}}{60\text{ min}} \times \frac{905\text{ completions}}{\text{yr}} \times \frac{\$6.00}{\text{mh}} = \frac{79.19\text{ mh}}{\text{yr}} = \$475/\text{yr}$$

elimination of manual data entry at DPSCPAC or IMA:

$$\frac{1324\text{ deferrals}}{\text{yr}} \times \frac{.034\text{ mh}}{\text{deferral}} \times \frac{\$4.40}{\text{mh}} = 45.02\text{ mh/yr} = \$198/\text{yr}$$

$$\frac{1104\text{ non-deferrals}}{\text{yr}} \times \frac{.034\text{ mh}}{\text{non-deferral}} \times \frac{\$4.40}{\text{mh}} = \frac{37.54\text{ mh}}{\text{yr}} = \$165/\text{yr}$$

$$\frac{.034\text{ mh}}{\text{deferral}} \times \frac{1\text{ deferral}}{443\text{ chars}} \times \frac{86\text{ chars}}{\text{completion}} = \frac{.0066\text{ mh}}{\text{completion}}$$

$$\frac{905\text{ completions}}{\text{yr}} \times \frac{.0066\text{ mh}}{\text{completion}} \times \frac{\$4.40}{\text{mh}} = 5.97\text{ mh/yr} = \$\ 26/\text{yr}$$

forms savings, OPNAV 4790/2K not sent to DPSCPAC or IMA:

$$\frac{3333\text{ forms}}{\text{yr}} \times \frac{\$\ .012}{\text{form}} = \$\ 40/\text{yr}$$

$$\frac{3333\text{ forms}}{\text{yr}} \times \frac{.1\text{ oz}}{\text{form}} \times \frac{\$\ .13}{\text{oz}} = \$\ 43/\text{yr}$$

CSMP handling and mailings:

$$\frac{12\text{ CSMP}}{\text{yr}} \times \frac{5.5\text{ lbs}}{\text{CSMP}} \times \frac{\$2.56}{\text{lb}} = \$169/\text{yr}$$

$$\frac{.75\text{ mh}}{\text{CSMP}} \times \frac{\$6.00}{\text{mh}} \times \frac{12\text{ CSMP}}{\text{yr}} = \$54/\text{yr}$$

Enclosure (1)

AWR handling and mailing:

$$\frac{4\text{ AWR pkg}}{\text{yr}} \times \frac{.4\text{ mh}}{\text{AWR pkg}} \times \frac{\$7.75}{\text{mh}} - \$12/\text{yr}$$

$$\frac{4\text{ AWR pkg}}{\text{yr}} \times \frac{20\text{ lb}}{\text{pkg}} \times \frac{\$2.56}{\text{lb}} = \$205/\text{yr}$$

Shipboard Storekeeper System:

posting requisitions:

$$\frac{.61\text{ min}}{\text{req}} \times \frac{1\text{ mh}}{60\text{ min}} \times \frac{\$6.00}{\text{mh}} \times \frac{9295\text{ reqs}}{\text{yr}} = \frac{94.5\text{ mh}}{\text{yr}} = \$567.00/\text{yr}$$

requisition status update:

$$\frac{.23\text{ min}}{\text{update}} \times \frac{1\text{ mh}}{60\text{ min}} \times \frac{9295\text{ reqs}}{\text{yr}} \times \frac{3\text{ update}}{\text{req}} \times \frac{\$6.00}{\text{mh}} = \frac{107\text{ mh}}{\text{yr}} = \$641/\text{yr}$$

departmental budget report preparation:

$$\frac{42.33\text{ min}}{\text{report}} \times \frac{12\text{ report}}{\text{yr}} \times \frac{1\text{ mh}}{60\text{ min}} \times \frac{\$6.00}{\text{mh}} = 8.47\text{ mh/yr} = \$51/\text{yr}$$

type DD1348

$$\frac{2\text{ min}}{\text{form}} \times \frac{9295\text{ forms}}{\text{yr}} \times \frac{1\text{ mh}}{60\text{ min}} \times \frac{\$6.00}{\text{mh}} = 310\text{ mh/yr} = \$1860/\text{yr}$$

$$\frac{\$\ .02}{\text{form}} \times \frac{9295\text{ forms}}{\text{yr}} = \$186/\text{yr}$$

post receipt documents:

$$\frac{.79\text{ min}}{\text{doc}} \times \frac{9295\text{ doc}}{\text{yr}} \times \frac{1\text{ mh}}{60\text{ min}} \times \frac{\$6.00}{\text{mh}} = 122.38\text{ mh/yr} = \$734/\text{yr}$$

keyenter and verify requisition:

$$\frac{9295\text{ reqs}}{\text{yr}} \times \frac{.43\text{ min}}{\text{req}} \times \frac{1\text{ mh}}{60\text{ min}} \times \frac{\$6.85}{\text{mh}} = \frac{102\text{ mh}}{\text{yr}} = \frac{\$700}{\text{yr}}$$

check requisition status aboard ships:

$$\frac{9295 \text{ reqs}}{\text{yr}} \times \frac{.43 \text{ min}}{\text{req}} \times \frac{1 \text{ mh}}{60 \text{ min}} \times \frac{3 \text{ checks}}{\text{req}} = 199.84 \text{ mh/yr} = \$1199/\text{yr}$$

Summary of Benefits:

Maintenance:

Documentation of deferred maintenance	$475
DPSCPAC data entry	198
DPSCPAC data entry	165
DPSCPAC data entry	26
forms	40
forms mailing	43
CSMP handling	54
CSMP mailing	169
AWR handling	12
AWR mailing	205
Sub-Total	$1,387

Supply:

posting requisitions	$567
requisition status update	641
budget report preparation	51
typing DD-1348	1,860
DD-1348 forms	186
posting receipt documents	734
key entry & verification	700
checking requisition status	1,199
Sub-Total	$5,938

TOTAL BENEFITS $7,325

SHIP'S LOGISTICS INFORMATION MANAGEMENT SYSTEM
SYSTEM DESCRIPTIONS

Source: Authorized ADP Schedule Price List, FSC Group 70, Part I, Section A.

Table D-2. Ship System

Qty	Description	GSA Net
1	CPU with 32K memory and 6 IO slots	$ 6,804.00
1	80 x 24 char., upper/lower case console CRT with controller and audio alarm	2,646.00
1	Work station with 32K memory, upper/lower case (80 x 24 char) CRT and MXB, audio alarm and keyboard clicker	6,331.50
1	line printer (240 lpm)	6,615.00
1	.5 megabyte dual removable diskette drive with controller	4,441.50
1	10 megabyte fixed/removable disk drive with controller	12,285.00
1	disk multiplexer	756.00
2	buffered asychronous communications controller RS232C	1,417.50
1	card reader/punch/verifier with RS232C interface	7,500.00
1	5-level, 11/16" paper tape reader/punch	2,912.00
1	RS232C interface	683.00
1	rack with slides	40.00
1	equipment enclosure	472.50
	Total Purchase	$52,904.00

Monthly Rent	$ 1,667.83
Monthly Maintenance	410.96
Annual Rent	$20,013.96
Annual Maintenance	4,931.52

Table D-3. Shore Support System

Augment for program maintenance:

Qty	Description	GSA Net
1	32K work station with upper/lower case CRT (80 X 24), keyboard, MXB, audio alarm and keyboard clicker	$ 6,709.50
2	buffered, asychronous communications controller	1,417.50
1	.5 MB dual removable diskette drive	4,183.00
1	disk multiplexer	756.00
1	132 col./120 CPS line printer	3,024.00
1	card reader/punch/verifier with RS 232 interface	7,500.00
1	5-level, 11/16" paper tape reader/ punch	2,912.00
1	RS232C interface	683.00
1	rack with slides	40.00
1	equipment enclosure	472.50

Total Purchase	$27,697.50
Monthly Rent	$ 945.33
Monthly Maintenance	189.96
Annual Rent	$11,343.96
Annual Maintenance	2,279.52

Table D-4. Development System

Qty	Description	GSA Net
1	CPU with 64K memory	$23,875.00
1	I/O processor	1,910.00
1	I/O processor	3,820.00
3	12" 80 x 24 char. upper/lower case CRT	8,022.00
1	line printer 220 lpm 4	8,595.00
1	10 megabyte fixed/removable disk drive	9,550.00
1	1600 bpi magnetic tape drive	12,415.00
1	COBOL compiler	2,865.00
	Total Purchase	$71,052.00
	Monthly Rent	$ 2,008.80
	Monthly Maintenance	553.00
	Annual Rent	$24,105.60
	Annual Maintenance	6,636.00

Summary

	GSA Net Purchase	Annual Rent	Annual Maintenance
Ship System	$ 52,904	$20,014	$ 4,932
Shore Augment	27,698	11,344	2,280
Development System	71,052	24,106	6,636
TOTAL	$151,654	$55,464	$13,848

ADPE LEASE VS PURCHASE ANALYSIS

Table D-5. Format 2A - Lease Costs

A Life Year	B Annual Rental	C Annual Maintenance and other	D Annual Cost	E Discount Factor	F Discounted Annual Cost
1	$ 55,464	$13,848	$ 69,312	.954	$ 66,124
2	55,464	13,848	69,312	.867	60,094
3				.788	
4				.717	
5				.652	
6				.592	
7				.538	
8				.489	
total	$110,928	$27,696	$138,624		$126,218

Table D-6. Format 2B - Purchase Costs

A Life Year	B Present Purchase Cost	C Annual Maintenance and other	C Annual Cost	E Discount Factor	F Discounted Annual Cost
1	$151,654	$13,848	$165,502	*1.0/.954	$164,865
2		13,848	13,848	.867	12,006
3				.788	
4				.717	
5				.652	
6				.592	
7				.538	
8				.489	
total	$151,654	$27,696	$179,350		$176,871

* Because the purchase cost is a one-time cost, it is not discounted. Only the maintenance charge is payable over the year and therefore is discounted.

Table D-7. Format 3 - Summary

A		B		
1	2	1	2	3
Terminal Year	Terminal Value	Final Analysis Year	Discount Factor	Discounted Terminal Value
2	$113,741	2	.867	$98,613

C. Total Purchase Cost (discounted) $176,871

D. Less Terminal Value (discounted) $ 98,613

E. Net Purchase Cost (discounted) $ 78,258

F. Total Lease Cost (discounted) $126,218

G. Higher Cost 1. $126,218 2. Using lease Method

H. Lower Cost 1. $ 78,258 2. Using purchase Method

I. Cost Advantage $ 47,960

J. Preferred Method see notes

Discounted Terminal Value = $151,654 (1 - 2/8) (.867)

NOTES:

1. If all equipment is leased with an option to buy and the equipment is purchased at the end of 2 years - the total discounted cost would be about $111,821.

2. Risk factors include equipment technical obsolescence, selection of different SNAP II equipment, project obsolescence, and the availability of funds of the right type.

APPENDIX E
COMMERCIAL MICROPROCESSORS
IN OTHER MILITARY PLATFORMS

This appendix presents supporting information regarding microprocessor capabilities being employed by the military. This information adds support to the overall findings of this study. The possible application of microprocessors to perform various shipboard functions, i.e., communications processing interfaced with appropriate encryption systems, could result in considerable cost savings to the Navy as well as increased shipboard reaction efficiency. To present the detailed information, each product line was identified as an item number, starting with sheet 1. Sheet 2 with the corresponding item number is a continuation of the product line. The data sheets are as follows:

- Tables E-1 and E-2 - Product Line Items 1 through 6
- Tables E-3 and E-4 - Product Line Items 7 through 15

Table E-1.

ITEM NO.	MANUFACTURER	MICROPROCESSOR IDENTIFICATION	MILITARY SYSTEMS USED IN	MIL-SPEC IF APPLICABLE	WORD SIZE IN BITS	ON-CHIP RAM SIZE	ON-CHIP ROM PROM SIZE	OFF-CHIP MEMORY	NO. OF BASIC INSTRUCTIONS	MAXIMUM CLOCK FREQUENCY	ON-CHIP CLOCK
1	Raytheon (Mountain View)	2901A	F-18, AYK-14, POP-11M	883-B	4-bit slice	64 bits	None	Yes	91	8.3 MHz	No
2	Hughes	HCMP 1802	MILES Program space shuttle	883-8	8	16x16	None	Up to -65K	90	6.4 MHz	Yes
3	Intersil	IM 6100 MOL	Flight data processing	883-8	12	UNK	UNK	32K	≈70	8 MHz @ 10v 4 MHz @ 5v	Yes
		IM 6100 AMOL	Airborne and space-borne telemetry							Short 2.5 4s @ 10v	
		IM 6100 MOL 88-3	Navigation and position-finding computers								
		IM 6100 AMOL 883-B	Jet-engine monitoring and control								
4	Ferranti	F 100-L	Ferranti lightweight sonobuoy processing System field intelligent Signal terminal (FIST)	BS 9000	16	N/A	N/A	32K	153	External clock 16 MHz −70°C, 5 MHz −55° +125°C, 8 MHz -70°C, 5 MHz -55°+125°C	No
5	Harris Semiconductor	HM 6100 HM 1B 6100-2 MIL TEMP MIL 883-8	Manpack communications (Cincinnati Electronics) 8CS TACFIRE (Horden) Backpack for space shuttle (Hamilton Standard) Various hand-held microcomputers	883-B 385108	16	None	None	8K words expanable to 64K	70+	8 MHz	Yes
6	National Semiconductor	IO 2901 AOM IO 2901A-IOM	CPU design peripheral controllers	883-3	Expandable 4-bit slice	None	None	Expandable in 4-bit slice	8 logic 5 arithmetic	145ns, 6.9 MHz 140ns, 7.14 MHz worst case with a 16 MHz shift	No
		INS 8080A INS 8080A-1 INS 8080A-2	Small system controllers	883/3 M-38510/440 applied for	8	None	None	65,536 byte	74	INS 8080A: 2.1 MHz INS 8080A-1: 3.125 MHz INS 8080A-2: 2.6 MHz	No

SHEET 1 OF 4

Table E-2.

ITEM (CONT)	TTL COMPATIBLE	BCO ARITHMETIC	ON-CHIP INTERRUPT LEVELS	SUBROUTINE NESTING LEVELS	GENERAL-PURPOSE INTERNAL REGISTERS	NUMBER OF I/O LINES	SUPPORT CIRCUITS	VOLTAGE REQUIREO	ASSEMBLY LANGUAGE	HIGH-OROER LANGUAGES
1	Yes	Yes	None	N/A	17	N/A	Yes	+5 Ground	RAYSAM	N/A
2	Yes	No	1	Limited by memory	16 16-bit 18-bit	10	Yes	Single +3v to 12v	YEST	FORTH
3	Yes at 5v	No	2	Limited by external RAM	1	12	6101, 6102, 6103, 6572, 6505, 6506, 6603, 7218	4-11v(CMOS)	PAL III	FOCAL FORTRAN ALGOL LISP
4	1.2/5.8	Yes	No	Single level up to 64 channels in descending order of priority						
5	Yes	Yes, via software algorithm	1/24 levels of vectored interrupts using HM 6100 PIE	Unbounded	First 128 locations of external memory	11	Yes	4-11v	PAL 8: MACREL/LINKER	BASIC FORTRAN IV FOCAL OIBOL PASCAL
6	Yes	No	User defined	User defined	16	User defined	Yes	+5 Ground	User defined	N/A
	Yes	Yes	Yes	Software stack	7	Addresses 256 inputs Addresses 256 outputs	Yes	+5v, +12v, -5v Ground	Yes	LLL BASIC

SHEET 2 OF 4

Table E-3.

ITEM NO.	MANUFACTURER	MICROPROCESSOR IDENTIFICATION	MILITARY SYSTEMS USED IN	MIL-SPEC IF APPLICABLE	WORD SIZE IN BITS	ON-CHIP RAM SIZE	ON-CHIP ROM PROM SIZE	OFF-CHIP MEMORY	NO. OF BASIC INSTRUCTIONS	MAXIMUM CLOCK FREQUENCY	ON-CHIP CLOCK
7	RCA Solid State Division	COP 1802 COSMAC	MAGSAT, MILES, STP, Solar Maximum. Secure communications	883/3 M-38510 late 1978	8	16x16		64K maximum addressing	91	6.4 MHz (10v) 3.2 MHz (5v)	Yes
8	Texas Instruments	SEP 9900A	Classified or proprietary	JAN38510/460 (preliminary)	16	None	8.8 microprogram	User selectable	69 7 addressing modes	DC-3 MHz	No
		SN54LS481	Classified or proprietary	883-B	4-bit slice	None	None	User selectable	24,780 micro operations	DC-7 MHz	No
9	Data General	MH 601	UNK	UNK	16	None	None	32K words	202	8.333 MHz	No
10	Western Digital	WD 16	UNK	UNK	16	8x16	2K	65K bytes	124	3.3 MHz	No
11	Zilog	Z80-CPUCM	UNK	883-B	8	None	None	65K bytes	158	2.5 MHz	No
12	Intel	8008	UNK	UNK	8/8	UNK	UNK	16K	48	0.82 MHz	No
		8080A	TLQ-17A F-18 store computer	UNK	8/8	UNK	UNK	64K	78	2.6/2 MHz	No
		8085	UNK	UNK	8/8	UNK	UNK	64K	80	3/1 MHz	No
13	Motorola	M6800	UNK	UNK	8/8	UNK	UNK	64K	89	2/1 MHz	No
		M6809	UNK	UNK	8/8	UNK	UNK	64K	100+	2/1 MHz	Yes
14	Fairchild	9440	UNK	UNK	16/16	UNK	UNK	64K	42	10/1 MHz	Yes
15	Advanced Micro-Devices	2900	UNK	UNK	4	UNK	UNK	UNK	16	10 MHz	UNK

SHEET 3 OF 4

Table E-4.

ITEM (CONT)	TTL COMPATIBLE	BCD ARITHMETIC	ON-CHIP INTERRUPT LEVELS	SUBROUTINE NESTING LEVELS	GENERAL-PURPOSE INTERNAL REGISTERS	NUMBER I/O LINES	SUPPORT CIRCUITS	VOLTAGE REQUIRED	ASSEMBLY LANGUAGE	HIGH-ORDER LANGUAGES
7	Yes on outputs; inputs require pull-up resistors	No	Interrupt capability on chip +4 ext. Flag lines	Unlimited with standard call and review routines	16 16-bit	3 "N" lines	Yes	4-12v	Support system with editor 6 assembler	FORTH
8	Yes	No	16	Unlimited	Uses external memory-to-memory architecture workspace	Data 16, Address 15, Control 17, Status 13	Yes	500mA	Compatible with T1900 software	FORTRAN COBOL BASIC PASCAL
	Yes	Microprogrammable	External, user selectable	User selectable	External, user selectable	Data 18, Address 4, Control 20, Power 2, Status 4	Yes	5v	MICASM	Microprogrammable
9	Yes	Yes	1/16	Infinite	4 16-bit registers	0062 16-bit port	Yes	+5v, +10v, +15v	Yes	FORTRAN BASIC Business BASIC D6/L
10	Yes	No	4/16	External stack size	6+2 (PG and SP)	11	Yes	+12v, +5v, -5v	Yes	BASIC
11	Yes	Yes	1 of 128 vectored priority handling	No limit	12 storage/address 2 accumulators 2 index	None	Yes	+5v	Yes	PLZ FORTRAN COBOL BASIC
12	No	Yes	8-bit external buses, 16-bit external buses	UNK	6	UNK	UNK	+5v, +9v	Yes	Yes
	Yes, except clockliness	Yes	UNK	UNK	8	Yes	UNK	+5v, +9v	Yes	Yes
	Yes	Yes	Standard or MOS circuits will surface	UNK	8	Yes	UNK	+5v, +12v, -5v	Yes	Yes
13	Yes	Yes	Has 18-bit external buses and 16-bit internal buses	UNK	None	Yes	UNK	+5v	Yes	Yes
	Yes	Yes	Has 18-bit external buses and 16-bit internal buses	UNK	None	Yes	UNK	+5v	Yes	Yes
14	Yes	No	Has 18-bit external buses and 16-bit internal buses	UNK	4	Standard TTL or MOS circuits will suffice	UNK	+5v	Yes	Yes
15	Yes	No	UNK	UNK	UNK	UNK	UNK	+5v	UNK	UNK

SHEET 4 OF 4

APPENDIX F
SEABORNE COMMERCIAL ADP EQUIPMENT, DATA SHEETS

The following tables are a condensation of the information obtained from various manufacturers of commercial ADP equipment that is being employed in the ocean environment and other military platforms. Identified in these tables are the possible naval applications of this commercial equipment. Wherever possible, reliability/maintainability information was included.

Table F-1.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA: SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	TECHNICAL DATA: SYSTEM/EQUIPMENT SPECIFICATIONS	REMARKS
1. Class and Manufacturer a. Commercial b. Honeywell Commercial Marine Operations, Inc. 2. Purpose of System/Equipment Dual Automatic Stationkeeping (ASK) system. Positioning control for drilling rigs and offshore diving and maintenance vessels. 3. Type of Commercial Employment Type Ship — No. a. Drilling vessels — 10 b. Mining vessels — 1 c. Diving/workover — 2 4. Possible Naval Applications a. Bridge command and control b. Navigation support c. Amphibious operation stationkeeping d. Maneuvering support e. On-station gunfire support amphibious operations f. Mobile replenishment operations	1. Dual Processing Unit a. H-316 computer - 2 each b. Real-time clock c. Radar positioning processor d. Cartrifile e. Primary power panel f. Computer interface unit g. Thruster/sensor interface unit h. Chassis with two storage drawers i. Power panel j. Interfaces: (1) Dual display unit (2) Acoustic position reference (3) Gyrocompass - 2 each (4) Wind correction sensor - 2 each (5) Radar remote transponder - 2 each (6) Radar receiver/transmitter - 2 each (7) Thruster commands/feedhack (8) Hardcopy page printer 2. Acoustic Position Reference Unit a. Subsea acoustic beacon - 2 each b. Ship-mounted hydrophones - 2 each c. Hydrophone "J" boxes - 2 each d. Vertical reference units - 2 each e. Vertical reference sensor (dual) f. Interfaces: (1) Dual display unit (2) Dual processing unit 3. Heading Reference Unit a. Gyrocompass - 2 each b. Transmission unit c. Interfaces with processing unit 4. Wind Correction a. Wind sensor - 2 each b. Interfaces with dual processing unit 5. Radar Position Unit a. Radar remote transponder - 2 each b. Radar receiver/transmitter - 2 each c. Interfaces with dual processing unit 6. Thruster Commands/Feedback Unit a. Main screws b. Rudder control c. Forward lateral thruster(s) d. Aft lateral thruster(s) e. Interfaces with dual processing unit 7. Dual Display Unit a. RS-7 processor/display unit - 2 each b. Acoustic system control panel - 2 each c. Alphanumeric display - 2 each	1. Normal Operating Environment a. Wind 35 knots plus 20-knot gusts of 1-minute duration and 10-second transient times b. Current 2.0 knots (surface velocity) c. Wave 4.9 meters significant wave height sea, average period less than 8.0 seconds 2. Survival Environment (assumes basic position reference is maintained) a. Wind 100 knots within ±10° of bow b. Current 2.0 knots (surface velocity) c. Wave 16.0 meters significant wave height sea 3. Noise Environment Ambient Noise: Less than -22dB RE 1μBAR/Hz @ 25 kHz (-6dB per octave slope) at the RS-7 hydrophone 4. Shipboard Environment a. Humidity 0 to 90% without condensation b. Salt Air Usual for enclosed shipboard conditions c. Shock ±2.0 Gs, ½ sine wave, 30 ms in all 3 axes d. Vibration Frequency (Hz) — Amplitude (mm) — Accelerated Max. Gs 4-8 — .75 — .6 8-14 — .50 — .6 14-30 — .25 — .9 30-100 — .05 — 1.0 5. Equipment Ambient Temperature a. Enclosed +10° to +30°C b. Exposed -10° to +55°C c. Subsea -1° to +55°C 6. Electrical Environment a. Primary Power 115 volts, 60 ±1Hz b. Harmonic Distortion 5% maximum c. Primary Power Voltage Regulation ±5%	

Table F-2. (cont.)

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA		REMARKS
	SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	SYSTEM/EQUIPMENT SPECIFICATIONS	
	d. Alarm indicator strip - 2 each e. Thruster control panel f. Keyboard assembly g. Dimmer panel drawer h. Console power supply drawer i. Console electronics drawer j. System control panel k. Joystick assembly l. Chassis with storage drawer m. Interfaces: (1) Acoustic position reference unit (2) Dual processing unit		

Table F-2.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	TECHNICAL DATA SYSTEM/EQUIPMENT SPECIFICATIONS	REMARKS
1. Class and Manufacturer a. Commercial b. Honeywell Commercial Marine Operations, Inc. 2. Purpose of System/Equipment Mini-ASK system. Positioning control for offshore diving and support vessels. 3. Type of Commercial Employment Type Ship — No. US Navy cable laying — 1 Diving/workover — 2 Diving — 2 4. Possible Naval Applications a. Bridge command and control b. Navigation support c. Maneuvering support d. Amphibious on-stationkeeping e. Mobile replenishment operations	1. Processing Unit a. H-316 computer b. Radar positioning processor c. Real-time clock d. Cartrifile e. Preliminary power panel f. Computer interface drawer g. Thruster/sensor/interface drawer h. Chassis with two storage drawers i. Interfaces: (1) Acoustic position reference unit (2) Heading reference unit (3) Wind correction sensor (4) Radar position unit (5) Hardcopy page printer (6) Thruster commands/feedback unit (7) Display unit 2. Acoustic Position Reference Unit a. Subsea acoustic beacons - 2 each b. Ship-mounted hydrophones - 2 each c. Hydrophone "J" boxes - 2 each d. Vertical reference unit e. Vertical reference sensor f. Interfaces: (1) Display unit (2) Processing unit 3. Heading Reference Unit a. Gyrocompass b. Transmission unit c. Interfaces with processing unit 4. Wind Correction Sensor Unit Interfaces with processing unit. 5. Radar Position Unit a. Radar remote transponder - 2 each b. Radar receiver/transmitter - 2 each c. Interfaces with processing unit 6. Thruster Commands/Feedback Unit a. Main screw(s) b. Rudder control c. Forward lateral thruster(s) d. Aft lateral thruster e. Interfaces with processing unit 7. Display Unit a. RS-7 processor/display unit b. Acoustic system control panel c. Alphanumeric display d. Thruster control panel e. Keyboard assembly f. Dimmer drawer g. Joystick assembly h. Chassis with storage drawer i. Interfaces: (1) Acoustic position reference unit (2) Processing unit	1. Normal Operating Environment a. Wind 35 knots plus 20-knot gusts of 1-minute duration and 10-second transient times b. Current 2.0 knots (surface velocity) c. Wave 4.9 meters significant wave height sea, average period less than 8.0 seconds 2. Survival Enviroment (assumes basic position reference is maintained) a. Wind 100 knots within $\pm 10^{\circ}$ of bow b. Current 2.0 knots (surface velocity) c. Wave 16.0 meters significant wave height sea 3. Noise Environment Ambient Noise Less than -22dB RE 1μBAR/Hz @ 25 kHz (-6dB per octave slope) at the RS-7 hydrophone 4. Shipboard Enviroment a. Humidity 0 to 90% without condensation b. Salt Air Usual for enclosed shipboard conditions c. Shock ± 2.0 Gs, ½ sine wave, 30 ms in all 3 axes d. Vibration Frequency (Hz) / Amplitude (mm) / Accelerated Max. Gs 4-8 / .75 / .6 8-14 / .50 / .6 14-30 / .25 / .9 30-100 / .05 / 1.0 5. Equipment Ambient Temperature a. Enclosed $+10^{\circ}$ to $+30^{\circ}$C b. Exposed -10° to $+55^{\circ}$C c. Subsea -1° to $+55^{\circ}$C 6. Electrical Environment a. Primary Power 115 volts, 60 ± 1 Hz b. Harmonic Distortion 5% maximum c. Primary Power Voltage Regulation $\pm 5\%$	To apply to naval operations, the software would in all probability have to be modified.

Table F-2. (cont.)

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA		REMARKS
	SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	SYSTEM/EQUIPMENT SPECIFICATIONS	
	8. <u>System Performance</u> a. <u>Heading</u> ±3° of set point b. <u>Position</u> (acoustic or radar) 7 meters or 5% for acoustic position, whichever is greater, in the operating environment for surge and sway excluding wave modulation and thruster/main screw saturation c. <u>Depth</u> ASK system will function properly in water depth from 30 to 500 meters, up to greater depths on special order d. <u>Area</u> Heading and position as stated within a circular area with a radius of 10% of water depth, centered over the beacon		

Table F-3.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	TECHNICAL DATA SYSTEM/EQUIPMENT SPECIFICATIONS	REMARKS
1. Class and Manufacturer a. Commercial b. Honeywell Commercial Marine Operations, Inc. 2. Purpose of System/Equipment Positioning control for off-shore service and support vessels 3. Type of commercial Employment a. Utility/workover 1 b. Crane/driving 3 c. Workover 1 d. Pipe layer 1 e. Stone dumper 1 4. Possible Naval Applications a. Bridge maneuvering support b. Stationkeeping amphibious operation c. Positioning for gunfire support, amphibious operation d. Mobile replenishment stationkeeping	1. Microprocessor Unit a. TOC-2000 b. Interfaces: (1) Wind correction sensor (2) Heading reference unit (3) RS-7 processor display unit (4) Radar position reference unit (5) 3-axes control console 2. Heading Reference Unit a. Master compass and control b. Alarm unit c. Speed and latitude compensator d. Transmission unit e. Interfaces with TOC-2000 processor 3. RS-7 Processor Display Unit a. Acoustic beacon - 2 each b. Hydrophone assembly - 2 each c. Hydrophone "J" boxes - 2 each d. Vertical reference unit 4. Radar Position Reference Unit a. Keyboard printer b. Radar data processor c. Radar control processor d. Radar remote transponder - 2 each e. Radar receiver/transmitter - 2 each f. Interfaces with TOC-2000 processor 5. Thruster Commands/Feedback Unit a. Main screw(s) b. Bow thruster(s) c. Stern thruster(s) d. Interfaces with 3 axes control console 6. 3 Axes Control Console (interfaces with Mode Selector) a. TOC-2000 processor b. 3-axes joystick assembly c. Thruster commands/feedback unit 7. System Performance a. Heading $\pm 3^\circ$ of set point b. Position (acoustic or radar) 7 meters or 5% of water depth for acoustic position, whichever is greater, in the operating environment for surge and sway excluding wave modulation and thruster/main screw saturation effects. c. Depth ASK system will function properly in water depths from 30 to 500 meters, up to greater depths on special order d. Area Heading and position as stated within a circular area with a radius of 10% of water depth, centered over the beacon	1. Normal Operating Environment a. Wind 30 knots plus 10-knot gusts of 1-minute duration and 10-second transient times b. Current 2.0 knots (surface velocity) c. Wave 4.9 meters significant wave height sea, average period less than 8.0 seconds 2. Noise Environment a. Ambient Noise Less than -22dB RE 1μBAR/Hz @ 50 kHz (-6dB per octave slope) at the RS-7 hydrophone 3. Shipboard Environment a. Humidity 0 to 90% without condensation b. Salt Air Usual for enclosed shipboard conditions c. Shock ± 2.0 Gs, ½ sine wave, 30 ms in all 3 axes d. Vibration Frequency (Hz) / Amplitude (mm) / Accelerated Max. Gs 4-B / .75 / .6 8-14 / .50 / .6 14-30 / .25 / .g 30-100 / .05 / 1.0 4. Equipment Ambient Temperature a. Enclosed $+10^\circ$ to $+30^\circ$C b. Exposed -7° to $+50^\circ$C c. Subsea 0° to $+30^\circ$C 5. Electrical Environment a. Primary Power 115 volts, 60 1 Hz b. Harmonic Distortion 5% maximum c. Primary Power Voltage Regulation $\pm 5\%$	

Table F-4.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA: SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	TECHNICAL DATA: SYSTEM/EQUIPMENT SPECIFICATIONS	REMARKS
1. Class and Manufacturer a. Commercial b. Honeywell Commercial Marine Operations, Inc. 2. Purpose of System/Equipment Tricomm. 3-axes joystick position control for commercial utility and support vessels 3. Type of Commercial Employment Type Ship — No. a. Diving/workover — 2 b. Utility/workover — 1 c. Crane/diving — 3 d. H/O supply — 2 e. Workover — 1 f. Pipe layer — 1 g. Stone dumper — 1 4. Possible Naval Applications a. Patrol craft b. Shoreward amphibious craft (1) LST (2) LCV (3) LCI (4) LCR	1. 3-Axes Control Console with Mode Select Interfaces with: a. Heading reference unit b. Wind sensor c. 3-axes joystick control assembly d. Thruster commands/feedback unit 2. Heading Reference Unit a. Master compass and control b. Alarm unit c. Speed and latitude compensation d. Transmission unit e. Interfaces with 3-axes control console 3. Thruster Commands/Feedback Unit a. Rudder control b. Main screw(s) c. Bow thruster(s) d. Stern thruster(s) e. Interfaces with 3-axes control console	1. System Performance Heading ±3° of set point 2. Shipboard Enviroment a. Temperature +10° to +30°C b. Humidity 0 to 90% without condensation c. Salt Air Usual for enclosed shipboard conditions d. Shock 2.0 Gs, ½ sine wave, 30 ms in all 3 axes e. Vibration Frequency (Hz) — Amplitude (mm) — Accelerated Max. Gs 4-8 — .75 — .6 8-14 — .50 — .6 14-30 — .25 — .9 30-100 — .05 — 1.0 3. Electrical Environment a. Primary Power 115 volts, 60 ±1 Hz b. Harmonic Distortion 5% maximum c. Primary Power Voltage Regulation ±5%	

Table F-5.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	 SYSTEM/EQUIPMENT SPECIFICATIONS	REMARKS
1. Class and Manufacturer a. Commercial b. Motorola, Inc. 2. Purpose of System/Equipment Mini-Range III, Mini-Ranger data processor. Survey work. Drill rig positioning, aircraft positioning, vehicle positioning, and ship positioning. 3. Type of Commercial Employment a. Ship positioning b. Drilling rig positioning c. Commercial fishing vessels (large) d. Aerial surveying e. Hydrographic surveying f. Ship tracking g. Aircraft tracking h. Armored vehicle tracking 4. Possible Naval Applications a. Ship stationkeeping, amphibious operation b. Beach party assault/landing craft control c. Landing beach survey d. Navigation functions support e. Offshore stationkeeping assistance by beach party	1. Mini-Ranger III interfaces with the Mini-Ranger data processor. 2. Mini-Ranger data processor interfaces with: a. Magnetic tape recorder/cassette b. Digital data source, i.e., depth sounder c. Track indicator d, Digital printer e. Data terminals f. Track plotters	1. Mini-Ranger Data Processor a. Operating speed--1.0 sec basic cycle time b. Memory capacity--up to 64 Kbytes, 12 or 16 Kbytes read-only memory c. Computational accuracy--40 bits binary precision plus 8 bits exponent and sign d. Position fixing interval--0.5 seconds e. Operator interface--serial ASCII, 10 or 30 characters-per-second. RS-232C and/or 20 mA current loop compatible f. Input/output--9 I/O connectors available TTL compatible, parallel BCD interface, standard g. Time-of-day clock--internal, 24-hour crystal controlled. Settable though operator's console h. Power input--100 watts, maximum i. Physical dimensions--44x46x14 cm j. Weight--16 Kg k. Operating temperature range--0° to 50°C 2. Track Indicator a. Display--horizontal meter type, both steering and distance traveled display b. Scale--steering: selectable; 5, 20, or 80 units/division. Normal and reverse indicators c. Operating voltage--powered from data processor d. Physical dimensions--11.5x23x18 cm e. Weight--1.8Kg 3. Mini-Ranger III Positioning System a. Frequency range--5400 to 5600 MHz b. Range--20 nm standard c. Coding--four selectable codes standard, 16 codes optional d. Probable range error--3 meters e. Range readout--six digits, meters standard, yards or feet optional. Dual simultaneous readout (single, alternative readout in nav mode) f. Digital output--BCD, TTL compatible plus 8421 logic g. Operating voltage: (1) Range console--115/230 vac, 50-400 Hz standard, 24-30 vdc optional (2) reference station--14-30 vdc	

Table F-6.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA		REMARKS
	SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	SYSTEM/EQUIPMENT SPECIFICATIONS	
1. Class and Manufacturer a. Commercial b. Motorola, Inc. 2. Purpose of System/Equipment Mini-Ranger III. Positioning 100 yards to 100 miles, used in survey, dredging, mineral exploration, aerial survey, and moving vehicle positioning 3. Type of Commercial Employment a. Offshore drilling b. Hydrographic survey c. Dredging platforms d. Commercial fishing vessels e. Helicopters f. Armored vehicles 4. Possible Naval Applications a. Landing beach party control b. Landing beach surveying c. Assault wave control	1. Receiver/transmitter unit with a 6dB omnidirectional antenna 2. Lightweight reference stations - 2 each 3. Flexibility of ranging is as follows: Range — Receiver/Transmitter 19 km (10 nm) — 6dB omni (standard) 37 km (20 nm) — 6dB omni (standard) 75 km (40 nm) — 6dB omni (standard) 110 km (60 nm) — 18dB rotating sector 200 km (108 nm) — 18dB rotating sector Reference Station 6dB omni 13dB sector (standard) 19dB sector 13dB sector (standard) 19dB sector	1. Basic System Specification a. Range--37 Km (20 nm) line of sight; 20 to 200 Km (10 to 108 nm) options available b. Accuracy--3 meters (10 feet) probable range error c. Frequency--5400 to 5600 MHz d. Coding--four selectable codes 2. Range Console a. Range readout--display channels A and B simultaneously with range limits available in meters (standard); yards or feet optional b. Output to peripherals--binary coded decimal, TTL. +8421 parallel c. Operating voltages--115/230 volts ac, 50-400 Hz (optional 24-30 volts dc power) d. Power consumption--77 watts (ac); 57 watts (dc) e. Operating temperatures--0° to +20°C f. Dimensions--43x45.7x14 cm (17x18x5.5 inches) table mount g. Weights--14 Kg (32 lb) ac power; 12.7 Kg (28 lb) dc power 3. Receiver/Transmitter Unit a. Antenna--6dB omnidirectional (25° elevation) b. Operating temperatures--40° to 60°C c. Power--supplied by range console d. Dimensions--15.8x23.5x16.5 cm (17x18x 5.5 inches) e. Weight--2.3 Kg (5 lb) with brackets 4. Reference Stations a. Antenna-- 13dB sector (75° azimuth, 15 elevation) b. Operating voltages--20-30 volts dc c. Power consumption--13 watts (nominal) d. Operating temperatures--54° to 71°C e. Dimensions--14x26x16.5 cm (5.5x10.25x 6.5 inches) f. Weight--2.3 Kg (5 lb) less antenna	

Table F-7.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, ANO POSSIBLE NAVAL APPLICATIONS	TECHNICAL OATA		REMARKS
	SYSTEM COMPOSITION, INTERFACES, ANO/OR OPERATING CHARACTERISTICS	SYSTEM/EQUIPMENT SPECIFICATIONS	
1. Class and Manufacturer a. Commercial b. Cubic Western Oata Corp. 2. Purpose of System/Equipment Automatic Ranging Grid Overlay (ARGO). Offshore positioning system. Use for: a. Seismic surveys b. Geophysical surveys c. Hydrographic surveys d. Oceanographics e. Preroute surveys f. Pipe laying route control g. Long-range positioning of ships 3. Type of Commercial Equipment a. Fishing vessels b. Orilling rig positioning c. Oredgers 4. Possible Naval Applications a. Landing beach survey b. Beach party offshore positioning c. Landing craft control d. Assault wave control	1. Control display unit interfaces with range processing unit. Can interface with other peripherals such as: a. Strip-chart recorders b. Oigital printers c. Computer/calculators 2. Range processing unit interfaces with control display unit and antenna loading unit. 3. Antenna loading unit interfaces with range processing unit. 4. Characteristics: a. System Type (1) Circular (range-range) navigation with active mobile and fixed stations (2) Combined ranging and hyperbolic modes available as options b. System Oescription (1) Fixed station consists of one range processing unit, one antenna loading unit, three interconnecting cables. (Appropriate antenna system required.) (2) Mobile station consists of one control and display unit, one range processing unit, one antenna loading unit, and four interconnecting cables. (3) RPUs and ALUs are directly interchangeable between fixed and mobile stations. (Appropriate antenna system required.) c. Maximum Range 400 nm (740 Km) daytime and 220 nm (480 Km) night. Ranges achieved are dependent on certain operational parameters. 5. Range Accuracy .02 lanes instrumental. .05 lines achievable field accuracy. a. Lane Width 74 to 94 meters, depending on the frequency in use. b. System Capacity 12 users with 2 ranges, 9 users with 3 ranges, and 7 users with 4 ranges. Unlimited users with 4 ranges. Unlimited users in the hyperbolic mode (optional). c. Frequency Band A single frequency between 1600 and 2000 kHz is required for range measurements. Lane identification (when used) requires a second frequency from 9% to 10.5% higher than the range frequency. Up to 16 fre-	1. Size and Approximate Weight a. Control and display unit--19x19x7 inches; 27 lb b. Range processing unit--19x19x7 inches; 38 lb c. Antenna loading unit--19x19x7 inches; 32 lb 2. Temperature Ranges a. Operating -20°C to +55°C b. Storage -40°C to +85°C 3. Input Power 22 to 32 vdc for all stations a. Fixed Station 4.5 amps average (maximum duty cycle); 21 amps peak (maximum) b. Mobile Station 8 amps average (maximum duty cycle); 24 amps peak (maximum)	

Table F-7. (cont.)

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA		REMARKS
	SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	SYSTEM/EQUIPMENT SPECIFICATIONS	
	quency pairs may be factory programmed to meet customer frequency allocations. These frequencies are then switch-selectable by the operator. d. <u>Transmit Bandwidth</u> 80 Hz e. <u>Transmit Output Power</u> 100 watts peak f. <u>FCC Type Acceptance</u> Granted December 1977 in accordance with part 91, Industrial Radio-Location Service, FCC Regulations. g. <u>Range Data Rate</u> Updated once each 2 seconds h. <u>Range Data Smoothing</u> Smoothing factors selected by operator for mobile station velocities from 0 to 20 knots.		

Table F-8.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA		REMARKS
	SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	SYSTEM/EQUIPMENT SPECIFICATIONS	
1. Class and Manufacturer a. Commercial b. Cubic Western Data Corp. 2. Purpose of System/Equipment a. Automatic positioning for ocean and aerial platforms b. Employed on platforms with responders on an established baseline 3. Type of Commercial Employment a. Survey ships, boats b. Helicopter survey requirements c. Submarine positioning support 4. Possible Naval Applications a. Landing beach survey support b. Beach party control of landing craft c. Coastal patrol-boat positioning d. Training exercise support	1. Operating Range 150 Km (300 Km by line crossing) 2. Range Accuracy 50 cm +1:100,000xrange 3. Maximum Range Rate 160 knots--higher rate possible with reduced resolution 4. Transmitted Power 1.0 watt maximum 5. Frequency Stability 1 part per million 6. Antenna Beamwidth (½ power) a. Directional Variable beam from 120° to 30° in horizontal; 10° vertical b. Omni 360° horizontal; 10° vertical 7. Display Rate Automatic: 1 per second Fine: 4 per second Intermediate/coarse: 2 per second External: on manual or electronic command, 1 per second maximum 8. Display 5-digit numerical to 9999.9 meters for both ranges based on index of refraction of 320N 9. Data Outputs 20-line binary-coded decimal 1-2-4-8 for each range 10. Communications Integral two-way communications from interrogator to all responders 11. Range Resolution 10 cm	1. Physical Characteristics RF assembly: 3-3/4x6-5/8x7-1/8 inches; 6 lb Interrogator: 11x20½x21 inches; 55 lb Responder: 8x14x11 inches; 22 lb Variable beam: 12x15x23 inches at 120°; 12 lb Omni: 15" long, 1¼" diameter; 1 lb 2. Temperature Operating: -10° to $+50^{\circ}C$ Storage: -65° to $+65^{\circ}C$ 3. Power Requirements Interrogator: 95 watts, 12 vdc Responder: 70 watts, 12 vdc Either unit available for 24 vdc operation	

Table F-9.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA: SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	TECHNICAL DATA: SYSTEM/EQUIPMENT SPECIFICATIONS	REMARKS
1. Class and Manufacturer a. Commercial b. Kent Navigation Systems 2. Purpose of System/Equipment Precision integrated navigation system--Instantaneous Velocity Acquisition (IVA). Applications are: a. Energy and mineral exploration b. Surveying and mapping c. Geophysical and hydrographic research 3. Type of Commercial Employment a. Drilling rigs b. Commercial cargo ships c. Commercial tanker ships d. Commerical fishing craft (deep-sea going) 4. Possible Naval Applications a. Navigation support b. Bridge command and control support c. On-stationkeeping support, amphibious operation	1. IVA interfaces with the following: a. Various navigation aids b. Minicomputer c. Monitoring unit d. Magnetic tape unit e. Line printer f. Keyboard display unit g. Deep-tracking Doppler sonar 2. Performance a. Bottom Tracking Minimum depth--15 meters Maximum depth--1300 meters 1500 meter typical b. Water Tracking Minimum--150 meters c. Accuracy Minimum--0.25% RMS Typical--0.01% RMS 3. Electrical a. Sonar Beams Three operating at 25 or 40 kHz b. Pulse Transmit Power 400 watts/beam into transducer c. Receiver Sensitivity 3μv with 3dB S/N ratio d. Sonar Beamwidth 5.7° or 3.0° at 3dB points	1. Power Consumption Electronic cabinet--1000 watts maximum Transmit power amplifier--1400 watts/pulse 200 watts/average 2. System Outputs a. Velocities relative to ship's axis depth--in either knots/hour, meters/second, or feet/second b. Water mass velocities, uncompensated--relative to 83.8°F and 35 parts/thousand c. Compensated--temperature only d. Formats--16-bit parallel word e. Optional velocity pulse train output, format fore, aft, port, starboard axis--100 Hz/knot, 200 Hz/knot, water track minus uncompensated and temperature compensated	

Table F-10.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA		REMARKS
	SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	SYSTEM/EQUIPMENT SPECIFICATIONS	
1. <u>Class and Manufacturer</u> a. Commercial b. Control Data Corporation 2. <u>Purpose of System/Equipment</u> a. Interactive analysis station requirements b. Flag war room support aboard ship 3. <u>Type of Employment</u> System was utilized aboard the USS KITTY HAWK in support of the FCCF 4. <u>Possible Naval Applications</u> a. Bridge command and control support b. Ship's critical equipment monitoring functions c. Command and control operational support functions d. FCCF support functions	1. CDC 1784-2 computer (which has been superseded by the Cyber 18-17B) 2. CDC 1784-2 interfaced with the following commercial equipment during test aboard the USS KITTY HAWK: a. Hazeltine 2DDD terminals - 6 each b. PEP 801 - 3 each c. Line printer d. Disks and disk controller e. Magnetic tape units (2 each) and controller f. Remex punch/reader g. Milgo plotter 3. Cyber-18 Characteristics: a. Processor--type: general-purpose microprogrammable digital b. Organization--register-oriented or file-oriented c. Word length--16 bits d. Microinstruction word--32-bit format; 2 microinstructions per micromemory address e. Micromemory type--semiconductor read/write memory (RAM) and/or read only memory (RDM) f. Micromemory size--512 words in 64-bit increments (on transform: maximum of 4D96 additional words available) g. Micromemory access time--70 nanoseconds. h. Arithmetic--binary with dynamic selection of 1's or 2's complement mode. Up to 4 parallel unrelated operations are possible in 1 microinstruction 4. Macromemory: a. Requirement--variable, according to application b. Type: (1) Core memory: available in 16K byte stacks, with a maximum of 32K bytes (2) MDS memory: available in 32K or 64K byte sensors, with a maximum of 128K (3) Parity and protect bits are available in the standard stack c. Memory speed--75D nanoseconds average cycle 5. Input/Output Interfaces: Display terminal (RS-232-C compatible)	1. <u>Mechanical</u> a. Construction--RETMA 19 inch, rack mountable b. Dimensions: (1) <u>Logic Chassis</u> Height--18.5 inches (47 cm) Width--17.5 inches (44.5 cm) Oepth--16.D inches (40.64 cm) (2) <u>Power Supply Chassis</u> Height--8.75 inches (22.25 cm) Width--17.5 inches (44.5 cm) Depth--16.D inches (4D.64 cm) c. Weight: Logic chassis--4D lb (18 Kg) Power supply--50 lb (45 Kg) d. Input Power--115 volts, 50/6D Hz 2. <u>Miscellaneous Features</u> a. Real-time clock b. Autodata transfer c. Direct memory access	Test conducted aboard USS KITTY HAWK as the FCCF. The FCCF interfaced with the multi-source control facility ashore. The Cyber 18-178 is being used by the Navy, but in what capacity and place of employment was unknown to CDC.

Table F-11.

CLASS OF EQUIPMENT, MANUFACTURER, USE, EMPLOYMENT, AND POSSIBLE NAVAL APPLICATIONS	TECHNICAL DATA		REMARKS
	SYSTEM COMPOSITION, INTERFACES, AND/OR OPERATING CHARACTERISTICS	SYSTEM/EQUIPMENT SPECIFICATIONS	
1. Class and Manufacturer a. AN/GYQ-21(V): Pure commercial and/or ruggedized equipment b. Bunker-Ramo Corporation c. Digital Equipment Corp. 2. Purpose of System/Equipment a. Communication multiplexer b. Communcation switching mode c. Front-end processing system for a large host computer d. Interactive analysis station for command centers and intelligence centers e. Research and development support 3. Type of Employment Two AN/GYQ-21(V)s have been fielded in 20-foot vans. a. Army--project master, Ft. Hood TX. Used to support tactical operations of new concepts and tactical organizations. Subject is moved to field training exercise (FTX) areas with the CONUS. b. Air Force--electronic test range, Eglin AFB FA. Moved about to support electronic systems tests. 4. Possible Naval Applications a. Shipboard communication multiplexer (store and forward) b. Flag command and control center aboard ship c. Flag or task force intelligence operations	Typical System Equipment Requirements: 1. Digital Equipment Corporation a. PDP-11/45/70-FS logic processing unit b. KW11-P programmable clock c. BMB873-YB bootstrap loader d. DA11-BD unibus link e. DTD3-FF unibus link f. TJU16-EA tape drive and controller g. TU16-EE tape drive h. CTS11-KM card reader/punch and controller i. PC11 paper tape reader/punch and controller j. LP11-WA line printer and controller k. VT-52 keyboard/display terminal l. LA36-CA DECwriter m. DD11-B backplane n. DB20962 housing o. FP11 floating point 2. Bunker-Ramo Corporation a. EMM(BR-1527) 96K memory b. BR-1535 disk controller c. BR-1536B dual disks d. BR-156B 16-channel redundant switch e. BR-1569 16-channel communication controller NOTE: Quantity of equipment varies to satisfy the operational requirements and functions of the user.	System specifications are lengthy due to the variable configurations and applications of the system's capabilities. AN/GYQ-21(V) systems are being procured and are currently being used by the Government in three major functional roles, as follows: 1. Front-end processor for a large host computer 2. Communication store and forward switching mode 3. Interactive analysis station system to support command and control requirements The system specification can be obtained by writing to: Commander Rome Air Development Center Air Force Systems Command Griffiss AFB NY 13441	AN/GYQ-21(V) utilizes RSX-11D software packages with variations to satisfy the operational requirement. It is estimated that more than 80% of these packages are available off-the-shelf.

APPENDIX G

LISTING OF FIELD VISITS

The visits are listed in order of contact.

VISITS

20 July 1978

Control Data Corporation, San Diego CA

Contact: Mr B Oakley

26 July 1978

USS GRIDLEY (CG 21), Long Beach Naval Shipyard CA

Contact: LCDR Dollard and CPO Pharr

2 August 1978

Scripps Institute of Oceanography, La Jolla CA

Contact: Mr L Abbott

12 September 1978

USCGC GLACIER, Long Beach Naval Shipyard CA

Contact: CAPT BS Little

13 September 1978

Wang Laboratories, Inc., Field Office, San Diego CA

Contact: Mr J Mathews

15 September 1978

Digital Equipment Corporation, Field Office, San Diego CA

Contact: Mr F Loeschner

20 September 1978

NAVOCEANO, Bay St. Louis MS

Contact: CDR Miller and Messrs G DuPont and H Meyers

6 November 1978

USS KITTY HAWK, North Island NAS CA

Contact: LT (JG) Reusch

15 November 1978

USCGC POLAR SEA, Todd Shipyard, Seattle WA

Contact: CAPT Kothe and ETCS Pinney

17 November 1978

COMNAVAIRPAC, North Island NAS CA

Contact: CDR Harshberger

20 November 1978

COMNAVSURFPAC, Coronado CA

Contact: Mr P Sutton

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- Commercial Literature Received
- OTHER Related Documentation

ORMS-RELATED REFERENCES

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4. Report 4560, Basic Guidelines for Performance Monitoring of Shipboard Machinery, by WR McWhirter, Jr, November 1975, DW Taylor Naval Ship Research and Development Center

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15. Advances in Test Measurement, volume 13,
1976, Published by the Instrumentation Society of America, Pittsburgh PA

COMMERCIAL LITERATURE RECEIVED

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3. Plessey Environmental Systems catalog
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7. IBM Series/1 Digest (hardware/software)
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9. Bunker-Ramo Corporation, information on the AN/GYQ-21(V) system (Ft. Hood and Eglin AFB)
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11. Kent Navigation Systems literature
12. TETRA Tech, Inc., literature
13. Undersea Research Corporation literature
14. Hewlett Packard literature
15. Wang Laboratories, Inc., literature and technical information

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GLOSSARY

ADP	Automatic Data Processing
AIMD	Aircraft Intermediate Maintenance Equipment
ALU	Antenna Loading Unit
ARGO	Automatic Ranging Grid Overlay
ASIMS	Automated Shipboard Information Management System
ASK	Automatic Stationkeeping
BASS	Bathymetric Survey System
BDAS	Boat Data Acquisition System
BOTOSS	Bottom Topographic Survey System
CDC	Control Data Corporation
CIC	Combat Information Center
CII	Computer Integrated Instruction
CMI	Computer Managed Instruction
COMNAVAIRPAC	Commander Naval Air Pacific
COMNAVSURFPAC	Commander Naval Surface Pacific
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CTU	Cassette Tape Unit
DBD	Database Design
DEC	Digital Equipment Corporation
DF	Direction Finding
DRU	Data Reduction Unit
DS	Data System Specialist
DTNSRDC	David W Taylor Naval Ship Research and Development Center
EMO	Electronic Maintenance Officer
EW	Electronic Warfare
FCCF	Flag Command and Correlation Facility
FMS	File Management and Information Retrieval System
FOD	Function Operational Design
FTX	Field Training Exercise
FY	Fiscal Year